Title

A life-course perspective on U.S. migration experience and later-life diabetes, hypertension, and depression for middle-aged and older Mexican adults

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A dissertation submitted in partial satisfaction for the degree of Doctor of Philosophy in Public Health

by

Jacqueline Marie Torres

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ABSTRACT OF THE DISSERTATION

A life-course perspective on U.S. migration experience and later-life diabetes,

hypertension, and depression

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Doctor of Philosophy in Public Health

University of California, Los Angeles 2014

Professor Steven P. Wallace, Chair

This dissertation explores the relationship between personal and spousal migration to the United States and later-life health for older Mexican adults living in Mexico in the context of other social determinants of health across the life-course determinants. I use the 2001 baseline wave of the Mexican Health and Aging Survey, a nationally representative sample of Mexican adults 50 years and older (born before 1951). I test the relationship between U.S. migration experience and later-life depression, diabetes, and hypertension for older Mexican men, and between spousal migration to the U.S. and later-life depression, diabetes, and hypertension for older Mexican women. I also examine the degree to which personal or spousal migration to the U.S. might mediate or moderate the relationship between early-life socio-economic status and health conditions, and later-life health outcomes. My results suggest that there is no significant main

effect of U.S. migration experience on later-life health for older Mexican men, although return U.S. migrant men who report lower socio-economic standing later in life appear to have elevated risk of depression and diabetes. On the other hand, older Mexican women whose spouses migrated to the U.S. have significantly increased odds of later-life diabetes and hypertension if those women are no longer in a union by the time of the survey. The adverse effects of spousal migration to the U.S. are exacerbated by women's domestic labor outside the home and lack of decision-making power relative to their spouses, but buffered by their own migration experience. Finally, although greater socio-economic disadvantage in childhood predicts both U.S. migration (personal and spousal), and increased odds of later-life depression, diabetes, and hypertension, there is no evidence that US migration experience explains this life-course trajectory of socio-economic status and health. There is also limited evidence that a U.S. migration experience alters the relationship between childhood conditions and later-life health. Overall, for this group of older Mexican adults, the adverse effects of past U.S. migration experience are only observed for women whose spouses migrated to the U.S. and who are no longer in a union, which contributes to theories of the gendered geographies of power, or the ways in which migration may have different effects for men and women – in this case women who primarily stayed behind in Mexico. On the other hand, contrary to theories of migration stress, having a U.S. migration history does not appear to have a substantial effect on the health of return Mexican migrant men.

The dissertation of Jacqueline Marie Torres is approved

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Acknowledgements

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Curriculum Vitae

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CONFERENCE PRESENTATIONS

Kathryn G. Kietzman and **Jacqueline M. Torres.** "Promise or Peril? How Low-Income Older Californians are Faring in the Face of Major Health Delivery Changes", UCLA Center for Health Policy Research Seminar; March 2014

Jacqueline M. Torres, Rebeca Wong. "Cumulative socio-economic disadvantage and depressive symptoms among older Mexican adults", Population Association of America; April 2013

Jacqueline M. Torres. "Childhood poverty and depressive symptoms for older adults in Mexico: A life-course analysis". Oral presentation, Gerontological Society of America, November 2012. **Winner:** Best Pre-Dissertation Research Paper, Behavioral and Social Sciences (BSS) section.

Jacqueline M. Torres, E. Richard Brown, Steven P. Wallace. "Left out: Health care reform and undocumented immigrants." Oral presentation at American Public Health Association (APHA), San Francisco; Oct, 2012.

Jacqueline M. Torres. "Childhood poverty and depressive symptoms for older adults in Mexico: A life-course analysis". Oral presentation, Emerging Scholars Panel at International Conference on Aging in the Americas, Los Angeles; Sept, 2012

Jacqueline M. Torres. "Cross-border ties and self-rated health status among 1.5 and 2nd generation Latinos in California", Oral presentation at UCLA's Migration, Ethnicity and Urban Inequality conference, Los Angeles; Mar, 2012.

Jacqueline M. Torres. "Cross-border ties and self-rated health status among 1.5 and 2nd generation Latinos in California". Oral presentation at the UCLA Migration Study Group, Los Angeles; Jan, 2011.

Jacqueline M. Torres and Steven P. Wallace. "Binational determinants of immigrant mental health: Results from the National Latino and Asian American Study (NLAAS)". Oral presentation at APHA, Washington, D.C., Nov, 2011.

Chapter 1: Background and Significance

1.1. *Introduction*

Mexico is currently undergoing a rapid demographic and epidemiologic transition with consequences for health and well-being. For one, longer life expectancy in combination with declining fertility rates have led to a quickly aging Mexican population (Ham-Chande, 2011). Adults 60 years and older are expected to rise from 6% of the Mexican population in 2000 to 15% in 2027. In contrast, this is half the time that it took U.S. and Japan to undergo the same shift in age structure (Wong & Palloni, 2009).

Meanwhile, the epidemiological transition has led to the rise of non-communicable diseases as leading causes of morbidity and mortality in Mexico. Between 1970 and 1990, mortality due to infectious disease fell from 7.7 per 1000 to 0.75 per 1000 while chronic or degenerative disease mortality rose from 1.04 to 2.15 per 1000 population in the same time period (Wong & Palloni, 2009). The leading causes of mortality in Mexico are now heart disease, diabetes, and cerebrovascular disease, and major depressive disorder is the largest contributor to disability (Stevens et al., 2008).

Within this shifting demographic and health context, there is an increasing interest in the life-course social determinants of health for older adults in Mexico. Unlike infectious diseases, which are mostly influenced by proximal causes such as hygiene and nutritional status, chronic conditions are influenced by a range of cumulative and latent factors over the life course. Even as medical and public health interventions have reduced acute illnesses, many older adults in Mexico experienced conditions of material deprivation and poor health in childhood as well as in mid-life, which may contribute to worse health in older ages. (A. Palloni, 1981). The long-term effects of these earlier life exposures are of increased interest to researchers in Latin American health and aging, particularly in a context of persistent economic inequality and unequal social protection for older adults (Wong & Palloni, 2009).

U.S. migration is another potentially important social determinant of later-life health in Mexico. Over the course of the 20th century, Mexico became the largest migrant sending country to the U.S. While Mexican immigrants increasingly settled in the U.S. towards the end of the 20th century, many earlier migrants returned to their communities in Mexico as temporary or 'circular' labor migrants (Durand, Massey, & Zenteno, 2001). For those older adults who are return U.S. migrants, most of whom are men, the migration experience may have an influence on long-term health and well-being. Periods of exposure to immigration-related stress, including discrimination, labor exploitation, and periods of family separation, as well as occupational hazards may have long-term, adverse consequences for the health of older return migrants (de Oca, García, Sáenz, & Guillén, 2011). On the other hand, U.S. migration may be associated with increased wealth accumulation once return migrants are back in Mexico, which can improve access to higher quality health care, and enhance a sense of well-being associated with socio-economic mobility (Gonzalez Vazquez, Bonilla Fernandez, Jauregui Ortiz, Yamanis, & Salgado de Snyder, 2007). This increased wealth can also enhance purchasing power relative to non-migrant counterparts, enabling the consumption of purchased foods, tobacco, and alcohol products (Ullmann, Goldman, & Massey, 2011). These multiple, countervailing influences of migration on health have the potential to alter life-course socio-economic and health trajectories that contribute to later-life health.

There is growing evidence of the health influences of U.S. migration on those who remain in Mexico (Bojorquez, Salgado de Snyder, & Casique, 2009; Creighton, Goldman, Teruel, & Rubalcava, 2011; Ullmann, 2012). For example, the stress associated with family separation, feared or actual family dissolution, and increased responsibility for the well-being of young children has been linked to more depressive symptoms for Mexican women whose spouses have migrated to the U.S. (Bojorquez et al., 2009; V. N. Salgado de Snyder, 1993). Family members of U.S. migrants may also benefits from socio-economic mobility, better access to quality health care, as well as potentially adverse consequences of increased access to purchased foods or tobacco products (Handley et al., 2013; Riosmena, Frank, Akresh, & Kroeger, 2012; Salinas, 2008). Little is known, however, about how family member migration influences long-term chronic disease and mental health outcomes for older Mexican adults. In addition, explanatory and moderating influences on this relationship between U.S. migration history and later-life health of return migrants and their family members have seldom been reported.

Given the massive shifts in the demographic and epidemiological landscape in Mexico, as well as the increasing recognition that personal and family member migration to the U.S. may play a role in long-term health outcomes, my dissertation will provide analyses that address the following research questions:

1. **What is the influence of personal and spousal migration to the U.S., on later-life diabetes, hypertension, and depression outcomes for middle-aged and older Mexican adults?**
2. **How does migration history, including family migration history, change the relationship between early childhood socio-economic and health conditions and later-life chronic disease and depression for middle-aged and older Mexican adults?**

1.2 Background

Mexico began to experience a rise in life expectancy at birth in the beginning half of the 20th century, from fewer than 36 years in 1930 to 62 years by 1970 (Ham-Chande, 2011). As of 2012, life expectancy at birth in Mexico was 77 years old (World Bank, 2012).[1] This rise in life expectancy has mostly been attributed to advances in broad public health interventions such as widespread vaccinations and vector eradication efforts (Wong & Palloni, 2009). Despite these medical improvements and longer expected life spans, those born during the first half of the 20th century continued to live with conditions of poor sanitation and nutrition, and low investments in education, particularly during the critical years of early life (A. Palloni & McEniry, 2007; Wong & Palloni, 2009).

Owing in part to the improvements in life expectancy, alongside declines in fertility, Mexico has also experienced a significant change in its age composition. As of 1970 children (0-14 years old) accounted for nearly half of the Mexican population; adults 65 and older accounted for less than 4% of the total population in the same year (Ham-Chande, 2011). By 2010, adults 65 and older accounted for 6.2% of the Mexican population – a slight increase over the previous forty years – but are expected to rise to 22.6% of the population by 2050, surpassing the percentage of Mexicans under 14 years old (17.4%) (Ham-Chande, 2011).[2] The recent and rapid rise in the older adult population in Mexico has led to increased concern for their health and aging outcomes, as well as the life-course and socio-economic determinants of these health outcomes (Angel & Whitfield, 2007; A Palloni, McEniry, Wong, & Pelaez, 2006). This concern

[1] By way of comparison, in 2012 life expectancy at birth was 79 years old in the U.S., Chile, and Costa Rica. Mexico's life expectancy surpassed that of Belize, Argentina, and Panama, all 76 years (World Bank, 2012).

[2] This represents an increase from about 7 million adults 65+ in 2010 to just under 29 million in 2050 (Ham-Chande, 2011).

is heightened by the fact that public policy in Mexico has been slow to respond to the historic lack of a safety net for older adults, as well as inequality in health insurance coverage and access to health care (Berenzon, Lara, Robles, & Medina-Mora, 2013; Knaul et al., 2012; A. Palloni & McEniry, 2007).

In addition to demographic shifts toward longer life expectancy and an aging population Mexico has been undergoing a transition in its epidemiological profile for several decades (J. A. Rivera et al., 2002). This transition has meant that communicable and infectious diseases no longer account for the majority of the disease burden or mortality in Mexico. By 2004, three-quarters of deaths in Mexico were attributed to non-communicable diseases like heart disease, cerebrovascular disease, and diabetes (Stevens et al., 2008). Non-communicable diseases, including major depressive disorder, as well as diabetes and heart disease, also accounted for over two-thirds of the loss of healthy life years in Mexico (disability-adjusted life years, or DALYs) in the same year. The leading risk factors contributing to mortality in Mexico are no longer lack of sanitation, hunger, or lack of access to prenatal care – although these still remain important concerns, particularly in the Southern region of Mexico. Instead, high blood glucose, high body mass index (BMI) and high blood pressure are the leading proximal risk factors attributed to morbidity and mortality in Mexico (Stevens et al., 2008).

This health transition has been uneven across different regions of Mexico (J. A. Rivera et al., 2002). For example, Mexican states in the North have epidemiological profiles that are similar to high-income countries, with a high burden of non-communicable disease and low rates of infectious diseases and infant and child mortality (J. A. Rivera et al., 2002; Stevens et al., 2008). Southern states have been slower to make this transition and continue to experience high rates of communicable disease mortality and under-nutrition, although the rates of chronic disease and chronic disease risk factors are increasing rapidly in this region (Barquera et al., 2010; Stevens et al., 2008). There is a similarly uneven transition between rural and urban areas of Mexico, as rural residents have less access to health care, lower levels of educational attainment and higher poverty rates than their urban counterparts, on average (V. N. Salgado de Snyder & Wong, 2007; Salinas, Al Snih, Markides, Ray, & Angel, 2010).

Another key element in Mexico's demographic and epidemiological change, as well as the health outcomes of the aging population, is the growth of international emigration to the U.S. Labor migration, predominantly from Western Mexico, was spurred at the turn of the 20th century by the development of railroads in the region and direct recruitment efforts from U.S. employers; the Bracero program (1942-1964) also created a massive circulation of labor migrants from Mexico to the U.S (Durand et al., 2001). By 1960, near the end of the Bracero era, an estimated 600,000 Mexican-born individuals were in the U.S. Even after the passage of Hart-Cellar Act in 1965, which placed restrictions on Mexican migration to the U.S., documented and undocumented migration largely persisted (Cerruti & Massey, 2004). By 1990 an estimated 4.4 million Mexican-born individuals were in the U.S., many of whom became legal residents under the 1986 Immigration Reform and Control Act (IRCA), had expanded opportunities for family member migration (Durand et al., 2001). As of 2012 an estimated 11.4 million Mexican-born individuals resided in the U.S., totaling just under 10% of Mexico's total population (Gonzalez-Barrera & Lopez, 2013).

The return of many migrants back to Mexico, and the continued social and economic ties between migrants and their non-migrant family members, have led to potentially close links between Mexico-U.S. migration and epidemiological shifts in Mexico (Creighton et al., 2011; Handley et al., 2013; Riosmena et al., 2012). In particular, up to 30% of emigrants return back to their countries of origin, although this figure has fluctuated considerably with historical, political, and economic changes in the U.S. and Mexico (Durand et al., 2001; Masferrer & Roberts, 2012). For example, labor migration during the first half of the 20th century was predominantly circular, with migrants making multiple trips abroad and back to communities of origin, but declined with increased border enforcement and rising costs of coming and going in the early 1990s (Riosmena, 2004). Even for those with no personal experience with migration to the U.S., many have migrant family members abroad.[3] Migration may influence the health of who remain in communities of origin through shifts in family and social networks, family and community level economic changes, access to health care, and the influence of changing norms and preferences around health-related behaviors and gender roles (Frank & Wildsmith, 2005; Handley et al., 2013; Riosmena et al., 2012; Salinas, 2008).

Within this demographic and health context in mind, I will next examine the prevalence and determinants of hypertension, diabetes, and depression in Mexico – the three causes of morbidity and mortality that are outcome measures for my dissertation. I will then examine some of the mechanisms linking socio-economic factors generally to later-life hypertension, diabetes, and depression, with some evidence from Mexico. Finally, I will focus on the role of the relationship of U.S. migration experience, including the migration of family members, and later-life chronic disease. I will focus in particular on the intersection of U.S. migration experience

[3] Hanson and Woodruff (2003) report the percentage of households with a family member in the U.S. based on a 10% subsample of the 2000 Mexican Census. There was wide variation by Mexican state: around 23% of households in Zacatecas, Guanajuato, and Aguascalientes had a family member in the U.S. as of 2000. Only <1% of households had a migrant family member in Quintana Roo, Tabasco, Chiapas, and the Federal District. These figures have likely increased in all regions of Mexico given the growth Mexican migration to the U.S. since 2000. Currently available data from the 2010 Mexican Census suggests that the *head of the household* had migrated at some point in the previous five years (2005-2010) in 5% of Mexican households overall (Censo de Población y Vivienda, 2013).

and other determinants of chronic disease outcomes, including life-course socio-economic status, prolonged stress exposure, and psycho-social resources.

Prevalence of hypertension, diabetes, and depression in Mexico

Hypertension, or high blood pressure[4], is one of the leading risk factors for heart disease, diabetes, and cerebrovascular disease, the leading three causes of mortality in Mexico (Stevens et al., 2008). Results from the 2006 Mexican National Health and Nutrition Survey (ENSANUT) found a measured (versus self-reported) hypertension prevalence rate of about 43% for the Mexican adult population. This is up from about a prevalence rate of about 25% in 1993.[5] Analyses of Mexican survey data for adults 50 years and older Mexico suggest prevalence rates of around 60% (Wheaton & Crimmins, 2013). The rise in hypertension in Mexico has occurred in the context of inadequate detection and treatment of chronic diseases. Based on the same 2006 ENSANUT study, Barquera and co-authors (2010) reported that 62% of respondents were not aware that they were hypertensive.[6] Only 15% of respondents received some kind of medical treatment for their hypertension, which primarily consisted of hypertensive medication.

Diabetes is the second leading cause of death in Mexico (Stevens, 2008). Diabetes is a chronic condition that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use insulin it produces. Raised blood sugar as a result of uncontrolled diabetes can lead to damage of the body’s nerves and blood vessels; if untreated, this damage can

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[4] Defined as systolic blood pressure of $\geq$ 140 mmHg and/or diastolic blood pressure of $\geq$ 90 mmHg.

[5] To compare, Barquera and authors (2010) report that rates of hypertension for Mexican adults in Mexico are not only higher compared to those observed for Mexicans living in the U.S., but that Mexican residents had increases in hypertension rates from 2000 to 2006 whereas Mexicans in the U.S. had declines over the same period.

[6] That is, they were diagnosed as part of a two-visit blood pressure reading, rather than reporting doctor-diagnosis of hypertension.

in turn lead to loss of eyesight, amputation of limbs, and heart disease (WHO, 2013). Diabetes prevalence rates based on the 2006 ENSANUT that used fasting blood samples were just over 14% for the entire Mexican adult population (Villalpando et al., 2010). Among middle-aged and older adults, prevalence rates were 31% for those 50-59 years old, 33% for those 60-69 years old, and 26% for those 70-97 years old.[7] Just under half of middle-aged and older adults who tested positive for diabetes reported being diagnosed by the doctor, indicating widespread under-diagnosis of diabetes. Finally, while about 85% of those previously diagnosed with diabetes received some kind of treatment (primarily anti-diabetic medication), the vast majority (~95%) of previously diagnosed respondents were considered to have poor or very poor control of their diabetes based on fasting glucose readings (Villalpando et al., 2010).

Major depressive disorder is now considered to be the leading cause of disability worldwide (Murray, Vos, Lozano, Naghavi, & Flaxman, 2012), and in Mexico (Stevens et al., 2008). Depression is a mental disorder characterized by symptoms of sadness, tiredness, or low self-esteem, as well as poor concentration, loss of interest in conducting daily activities, and disturbances in sleep or appetite (World Health Organization, 2011). Although depression often begins early in life, it can continue on or recur in older adulthood, often with adverse consequences for chronic disease and physical and cognitive functioning (Krause, 1999; Wagner, Gallo, & Delva, 1999). On the other hand, many individuals experience their first onset of depression later in life, often with sharp increases around 60 years old (Krause, 1999). In addition, depression can range in severity, varying from moderate symptoms that may not

[7] Diabetes prevalence rates for doctor-diagnosed diabetes calculated from surveys of middle-aged and older adults in 2001 (the Mexican Health and Aging Study) and 2002 (the Mexican Family Life Survey) are between 17% and 24% for women and between 6% and 17% for men) (Andrade, 2010; Wheaton & Crimmins, 2013), suggesting underestimates without the blood draws.

require specialist care to severe depression, or major depressive disorder, that may require clinical mental health treatment.[8]

Prevalence estimates for depression among adults in Mexico range across measurement and study population. Using the 2001/2002 Mexican National Comorbidity Study, Medina-Mora and authors (2007) estimated that 9.6% of adults 55-65 years met the criteria for major depressive disorder in their lifetime. Bello and co-authors (2005) estimated the 12-month prevalence of major depression to be 9.5% among women and 5% for men 60 years and older in Mexico. However, in a cross-national survey, Guerra and authors (2009) reported that 32% of older Mexican adults had "clinically significant depression", more broadly defined, with estimates ranging from about 16.7% for urban and rural Mexican men between 65 and 69 years old to 44% for rural Mexican women in the same age group. Although awareness about the prevalence of depression among older adults in Mexico has increased over the past decade, there continues to be inadequate attention to the social determinants of depression and to the availability of mental health treatment (Berenzon et al., 2013; Wagner et al., 1999).

Having documented the demographic context and the profile of hypertension, diabetes, and depression, I next examine some the socio-economic and life-course determinants linked to hypertension, diabetes, and depression, the mechanisms explaining these relationships, and some of the evidence and counter-evidence from Mexico. After that, I examine the evidence linking U.S. migration experience, including family member migration, to hypertension, diabetes, and depression outcomes in Mexico.

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[8] Major depressive disorder is a more narrow diagnosis that requires that depressive symptoms interfere with normal work, sleep, eating, or enjoyment of otherwise pleasurable activities and excludes depressive symptoms or episodes due to bereavement.

Socio-economic and life-course determinants of later-life health: mechanisms and evidence

The rise of hypertension and diabetes in Mexico, and other consequent conditions of heart disease and cerebrovascular disease has been attributed to a shift in behavioral and environmental factors. These factors include increased rates of overweight and obesity[9], increased sodium, sugar and refined carbohydrate consumption, rising tobacco and alcohol consumption, and more sedentary lifestyles resulting from the decline in small-scale agricultural and rapid urbanization (Barquera et al., 2010; J. A. Rivera et al., 2002). While these lifestyle factors are important, chronic disease like diabetes, heart disease, and hypertension more broadly are also closely linked to social and economic conditions across the life-course (Harper, Lynch, & Davey Smith, 2011; Lynch & Davey Smith, 2005; Marmot et al., 1991). These 'upstream' social and economic factors likely intersect with behavioral changes in consumption and activity, as well as macro-level changes in the food environment and the nature of work, to influence chronic disease outcomes.

Socio-economic status, including relative socio-economic position, but also absolute poverty, financial strain, and lower educational attainment, have been linked to chronic disease outcomes like diabetes and hypertension through their influence on access to information about health-related risks and resources, and access to medical care to help mitigate and manage these risks (Link & Phelan, 1995). However, socio-economic gradients in chronic disease outcomes seem to persist even with similar access to health care (Marmot et al., 1991). This has led

[9] Significant increases in obesity were observed for Mexican women starting in the late 1980s, and for both men and women by 2000 (Barquera et al, 2009). In 2006, 37% of Mexican women and 24% Mexican men were obese, with the highest rates found among those between 50 and 59 years old (Barquera et al, 2009).

researchers to turn to biological mechanisms and psycho-social mechanisms to explain the relationship between socio-economic status and physical and mental health outcomes (Matthews & Gallo, 2011). For example, conditions of absolute poverty and relatively low socio-economic status have been linked to feelings of lower perceived control over one's life chances, less access to supportive social networks and greater reliance on coping strategies like smoking and alcohol consumption (Marmot et al., 1991).

Living in poverty or having lower relative socio-economic status are each associated with acute and prolonged exposure to stress, which can influence physical health outcomes through the cumulative wear and tear on physiological response systems, or "allostatic load" (E. Crimmins, Kim, & Seeman, 2009; Matthews & Gallo, 2011; McEwen & Seeman, 1999; Seeman et al., 2004). Specifically, long-term exposure to stress can lead to elevated blood pressure, a risk factor for both heart disease and diabetes. Stress also triggers the release of cortisol by activating the hypothalamus-pituitary-adrenal (HPA) axis; increased cortisol production may be related larger waist circumference – a risk factor for heart disease and diabetes (Gallo, Espinosa de los Monteros, Ferent, Urbina, & Talavera, 2007).

Depression is also strongly related to social and economic determinants of health, in addition to individual and interpersonal factors including role disruption (e.g. divorce, retirement), social support and isolation, and family history of depression (Kahn & Pearlin, 2006; Stansfeld, Clark, Rodgers, Caldwell, & Power, 2011). The link between socio-economic status and depression is often explained by lower levels of mastery, or perceived personal control over one's life, and lower levels of self-esteem and optimism, among those with fewer social and economic resources (Bojorquez-Chapela, Manrique-Espinoza, Mejía-Arango, Solis, & Salinas-Rodriguez, 2012; Kahn & Pearlin, 2006; Krause, 1999). Chronic and acute stress exposure due to educational and occupational disruptions, financial strain, environmental stressors, and discrimination is also associated with later-life depression, particularly in contexts with limited access to mental health treatment or other coping mechanisms (Myers & Hwang, 2004). There is also a strong reciprocal relationship between depression and socio-economic status, whereby major depression may inhibit an individual's ability to work or limit the kinds of work they due, in turn leading to fewer economic resources (Stansfeld et al., 2011). Finally, while chronic depression that begins in early life (e.g. adolescence) has been more strongly linked to family disruptions and parental depression history, onset of depressive symptoms in older adulthood may relate more directly to current life stressors, including financial strain or declines in health and mobility (Krause, 1999; Myers & Hwang, 2004).

Recent literature on the health of older adults has placed increased attention on the relationship between social and economic determinants across the life-course and later-life chronic disease outcomes, including hypertension and heart disease more broadly (Harper et al., 2011), diabetes (Best, Hayward, & Hidajat, 2005), and depression (McLaughlin et al., 2011; Stansfeld et al., 2011). Conditions of the intrauterine environment including poor maternal health and nutrition and higher levels of maternal stress have been linked to greater risk for heart disease later in life. Poor maternal nutrition and health in the gestational period might lead to impaired development of infant blood vessels, the heart and other organs, which in turn contributes to higher blood pressure and greater risk for cardiovascular disease in adulthood (D. J. Barker & Clark, 1997; D. J. P. Barker, 1993). Early-life conditions like poor fetal nutrition resulting from lower socio-economic status have been linked to greater susceptibility for insulin-resistance later in life, leading to increased risk of diabetes in adulthood (Osmond and Barker, 2000; Tamayo et al, 2010).

Other aspects of childhood socio-economic status including material deprivation, lower educational attainment, poorer nutrition, and higher exposure to family-level stress related to poverty or family disruptions have been linked to both later-life chronic disease and depressive symptoms. For example, chronic hunger has been linked to later-life diabetes in part because those who experience prolonged periods of hunger may be primed to over-consume when food does become available, and may prefer higher carbohydrate foods that will help ward off starvation. Long-term periods of hunger and weight-loss followed by high consumption and weight gain may provoke a cycle of hypo and hyperglycemia that can contribute to the onset of diabetes (Seligman & Schillinger, 2010). Family-level financial strain during childhood, potentially linked to greater exposure to family conflict or pressure to leave school early, may contribute to early onset depression, which may then recur in mid and later-life (Krause, 1999).

Despite the strong connections made between socio-economic status and later-life chronic disease and depression outcomes, the relationship may be more complicated in the case of Mexico. Specifically, there is often evidence of a reverse social gradient in some areas of Mexico (Buttenheim, Wong, Goldman, & Pebley, 2010; Fernald & Adler, 2008; Smith & Goldman, 2007; Villalpando et al., 2010).[10] The rural poor in Mexico may not have the purchasing power to consume higher calorie foods, tobacco and alcohol products, or afford the sedentary lifestyles that increase risk for chronic disease (J. A. Rivera et al., 2002), although there is evidence of either a flat, or a more traditional inverse social gradient in chronic disease outcomes in urban areas. Nevertheless, gradients in chronic health conditions like heart disease

[10] There may also be important differences in the social gradients in health for men and women, whereby women in Mexico have been observed to have the social gradients in chronic health risk factors like obesity and hypertension observed in wealthier countries (i.e. higher socio-economic status is associated with better health) whereas the inverse seems to be true for men (Beltran-Sanchez et al, 2011; Barquera et al, 2010).

and diabetes, problems historically associated with affluence in low and middle-income countries, appear to be taking on the character of social gradients of wealthy nations across the globe (Unwin, Whiting, & Roglic, 2010). In Mexico, the rates of hypertension and obesity are also rising more rapidly in the Southern and more rural regions, suggesting a “catch-up” effect (Barquera et al., 2010; Stevens et al., 2008). Even in areas in which the poorest individuals are at lower risk for developing chronic diseases, they are more likely to bear more serious financial and social consequences that come with the high costs of chronic disease management and may have poorer health outcomes once they have the disease (Unwin et al., 2010). Finally, depression outcomes in Mexico appear to follow the more traditional inverse social gradient, where higher socio-economic status across the life-course is associated with fewer depressive symptoms (B. E. Alvarado, Zunzunegui, Béland, Sicotte, & Tellechea, 2007; Torres & Wong, 2013).

There is some evidence of the long-term relationship between early-life socio-economic conditions and other health-related conditions (e.g. nutrition, disease exposure) and later-life chronic disease outcomes in Mexico and Latin America generally. For example, Kohler and Soldo (2005) found a significant association between lower levels of maternal education and reporting a serious childhood health condition, respectively, and increased odds of doctor-diagnosed diabetes among middle-aged and older Mexican adults. This relationship held even when controlling for other socio-economic and health-related risk factors in childhood and adulthood. Beltrán-Sanchez and co-authors (2011) found that having household sanitation facilities in one’s household during childhood, a potential indicator of better family-level material conditions as well as lower infectious disease exposure, was associated with significantly lower odds of hypertension for women in a nationally representative sample of Mexican adults, even when controlling for educational attainment, and overweight and obesity.

This association also held for women in both rural and urban areas, although the childhood sanitation facilities and later-life hypertension association was stronger for younger age cohorts (e.g. 59 years or less) compared to those 60 years and older.

There is also an important intersection between gender and socio-economic determinants of later-life health in studies of chronic disease and depression in Mexico (V. N. Salgado de Snyder & Wong, 2007). Overall, women in Mexico are more likely to report chronic disease outcomes and higher levels of depression (Berenzon et al., 2013; A. Palloni & McEniry, 2007). Men and women may be differently exposed to social and economic resources that may be influential for chronic disease and depression outcomes. For example, studies of older adults in Latin America more generally have suggested that women report lower levels of educational attainment and more experiences of childhood hunger, factors that have been linked in turn to later-life depression and other health and aging outcomes (B. E. Alvarado et al., 2007). Later in life, women in Mexico are much less likely to have accumulated their own wealth or benefit from a formal financial safety net (e.g. a pension), given fewer average years of work, which may contribute to women's greater risk for chronic disease and depression, but also means they have fewer personal resources to manage health conditions once they arise (V. N. Salgado de Snyder & Wong, 2007; Salinas & Peek, 2008).

In addition to differential exposure to social and economic resources by gender, men and women may be differentially vulnerable to the adverse effects of poverty and lower relative socio-economic status across the life-course (Best et al., 2005; Hamil-Luker & O'Rand, 2007). For example, women might face a higher likelihood of developing later-life diabetes given poor childhood socio-economic status, in part because early-life SES may contribute to a higher likelihood of developing gestational diabetes, which turn raises the risk of diabetes onset later in life (Best et al., 2005). In addition, given similar socio-economic profiles, men are much less likely to seek out medical services, and primary care in particular, suggesting that men might be more vulnerable to socio-economic barriers to healthcare (Salinas et al., 2010).

Chronic disease and depression in the context of U.S. – Mexico migration

Within the broader demographic and epidemiological context I have described, I now focus on the effect of U.S. migration on later-life diabetes, hypertension, and depression outcomes for return migrants and the family members of U.S. migrants in Mexico. The literature on Mexican immigrant health in the U.S. suggests that the experience of living in the U.S. as an immigrant (or 'exposure' to the U.S.) contributes in a non-trivial way to increases in chronic disease and depressive symptoms over time. These health changes may potentially have long-term consequences for the later-life health of return migrants (de Oca et al., 2011).

Despite an initial health advantage (Jasso, Massey, Rosenzweig, & Smith, 2004; Markides & Coreil, 1986),[11] immigrant health researchers, largely focused on Mexican-origin immigrants in the U.S., have observed health declines, or at least convergence with the prevailing rates of health risk behaviors and health outcomes among the U.S.-born (Antecol & Bedard, 2006; Breslau et al., 2011; Cook, Alegria, Lin, & Guo, 2009; Creighton, Goldman, Pebley, & Chung, 2012). This trend of poorer physical and mental health status with more time living as an immigrant in the U.S. has been explained as the result of lifestyle and environmental changes that encourage higher calorie diets, more sedentary lifestyles, and greater consumption of tobacco and alcohol products (Antecol & Bedard, 2006). Other explanations for this decline

[11] There is little evidence that immigrants from Mexico are healthier than their non-migrant, Mexican counterparts (Rubalcava, Teruel, Thomas, & Goldman, 2008). The health advantage is largely based on comparisons of some health outcomes for Mexican immigrants to their U.S.-born, Mexican-American counterparts.

include the loss of "protective" cultural characteristics (Lara, Gamboa, Kahramanian, Morales, & Bautista, 2005), stress resulting from acculturation experiences likely family cultural conflict (F. I. Rivera et al., 2008), loneliness or other results of family and social network disruption (Muñoz-Laboy, Hirsch, & Quispe-Lazaro, 2009; Viruell-Fuentes & Schulz, 2009), and the adverse health effects of discrimination, occupational hardships, and poor access to adequate health care, particularly for undocumented immigrants in the U.S. (Viruell-Fuentes, 2007).

The literature on the health of Mexican immigrants in the U.S. raises questions about how this observed increase in chronic disease risk factors and depressive symptoms may continue to impact the later-life health outcomes of return migrants now in Mexico. In particular, how does the migration experience intersect with other social and economic determinants of health, including early-life and current economic conditions, to influence later-life health outcomes? If migration to the U.S. is associated with poorer health outcomes, do return migrants continue to have higher rates of hypertension, diabetes, and depression once returned to the Mexican context? In addition, given the increased wealth of older return migrants in Mexico compared to their non-migrant counterparts (Wong & Gonzalez-Gonzalez, 2010), is migration associated with better or worse health outcomes in light of the complex relationship between SES and health in Mexico? I now consider these questions with a review of the evidence on the health of return U.S. migrants in Mexico.

1.3 Literature on migration and the health of return migrants

An estimated one-third of Mexican immigrants to the U.S. eventually return home to live (Van Hook and Zhang, 2011). Return migrants represent a non-random sample of the total immigrant population[12] (Van Hook and Zhang, 2011), with important differences in pre-migration circumstances, including pre-migration health, as well as immigrant social networks, age of migration, marital status, and remaining ties in Mexico (D. S. Massey, 1987; Van Hook & Zhang, 2011). These pre-migration circumstances, as well as the experience of migration and of working and living as an immigrant in the U.S., may contribute to the health of migrants long after their return home (de Oca et al, 2011; Salgado de Snyder, 2008).

Studies of return migrant health outcomes, including the health of return migrants later in life acknowledge that immigration may contribute to long-term health outcomes in both positive and negative ways. Migration may create opportunities for socio-economic mobility, perhaps altering or attenuating the relationship between childhood socio-economic context and health later on. For example, Wong and González-González (2010) found that among older Mexican men, those with U.S. migration experience reported significantly greater wealth in later-life than those who never migrated to the U.S. but had similar levels of education. Similarly, findings from qualitative research, including research on return migrants in Mexican communities in the 1960s through 1980s (Alarcón, 1988; López Castro, 1986; D.S. Massey, Alarcon, Durand, & González, 1987; Wiest, 1983), as well as more recent accounts of those return migrant men in older adulthood (Gonzalez Vazquez et al., 2007; V.N. Salgado de Snyder, 2007) suggest that U.S. migration experience enabled them to improve the quality of their family's economic conditions and social standing. In addition to greater ability to meet the costs of basic needs, and

[12] There are also significant demographic differences recorded for return migrants as compared to the total population of Mexican migrants to the U.S. Return migrants tend to be disproportionately male, more likely to be 50 years or older, and more likely to be younger compared to the Mexican immigrant population 'at risk' of return migration (Masferrer and Roberts, 2012). Households with return migrants as of 2005 also tended to have better indicators of household assets and access to basic services compared with other households in Mexico.

potentially improve material conditions and increase wealth, US return migrants often enjoyed social benefits from elevated financial and social standing, including positions of power in local politics and the approval of their family members (Alarcón, 1988; Wiest, 1983).

Of particular importance in older adulthood, improved financial status has allowed return migrant men access to higher quality medical care and, in turn, better health than their non-migrant counterparts despite similar childhood socio-economic and health contexts(Gonzalez Vazquez et al., 2007). These findings suggest even under similar conditions of childhood educational attainment or health context, the experience of U.S. migration might alter mid-life socio-economic status, in turn influencing health through access to better quality health care, and a better standard of living in older adulthood. While these studies did not assess depressive symptoms and chronic disease outcomes in particular, they are suggestive of better access to health care and higher self-rated quality of life, factors that might contribute to or reflect better physical and mental health.

With respect to chronic disease management, Salinas (2008) describes some of the particular benefits that middle-aged and older Mexicans with past and continued migration to the U.S. may have when it comes to managing their chronic health outcomes. Based on a qualitative study of diabetic clinic patients in two communities in Michoacán, Mexico, Salinas found that those who moved back and forth between the U.S. and Mexico, but received health benefits on the U.S. side of the border, received many more resources as the result of their public health coverage abroad than compared to what non-migrants received through public services in Mexico. Migrants who returned to live in Mexico permanently had greater financial resources and were able to pay monthly premiums to get better quality healthcare through labor-based health coverage programs rather than settle for public health care if they were not otherwise eligible. While non-migrants or former migrants with family members in the U.S. often reported fewer options for support with hands-on care related to their diabetes, they also reported greater access to health care and equipment to manage diabetes due to remittances or direct receipt of items like glucosameters from family members abroad (Salinas, 2008).

Despite the potential benefits of U.S. migration experience on later life health -- effects that have been documented primarily among male return migrants -- migration may also influence life-course health trajectories by increasing exposure to stressors, such as occupational hazards or discrimination, or to US norms around diet and substance use that have adverse effects on health, regardless of childhood advantage or disadvantage. For example, de Oca and authors (2011) describe findings from interviews with older return Mexican migrants and their counterparts who remained in the U.S. Many of these respondents reported migrating in early life in relatively good health compared to their non-migrant counterparts to work as agricultural laborers. These respondents linked years of cumulative exposure to hazardous and repetitive work conditions, and the stress of discrimination and occupational exploitation to more rapid indicators of aging compared to those who remained in Mexico, including more functional limitations and other physical symptoms.

Another set of articles that include older return migrant samples have supported the idea that return migrants from Mexico are less healthy, at least when compared to their counterparts who remain in the U.S. (Aguila, Escarce, Leng, & Morales, 2013; Riosmena, Wong, & Palloni, 2013). These articles are not inherently interested in the health of return migrants per se, but are rather engaged in tests of the ‘salmon bias’ – the idea that mortality advantages among Mexican immigrants in the U.S. might be due to the return of the least healthy among them back to Mexico. In some of these cases, often involving comparisons of survey data in Mexico and the

U.S., return migrants do have poorer health outcomes than their counterparts who remain in the U.S., although the evidence is generally weak.

For example, Riosmena, Wong, and Palloni (2012) compared return Mexican migrant men 50 years and older to a U.S. sample of Mexican and Mexican American men in the same age group. They found evidence that return migrants with 15 years or less cumulative time in the U.S. had significantly greater odds of smoking and poor self-reported health than their counterparts in the U.S. but there were no significant differences in the odds of obesity, diabetes, or hypertension. Among those with 15 year or more in the U.S., there were almost no significant differences in the odds of reporting diabetes, obesity, smoking, or poor health, for return migrants versus those who remained in the U.S. Aguila and authors (2013) also compared older adults in Mexico to Mexican-born older adults in the U.S. and found that return migrants and non-migrants had significantly lower odds of reporting difficulty with at least one activity of daily living compared to immigrants in the U.S.; return migrant and non-migrant women were significantly less likely to be obese than immigrant women, suggesting better health on some indicators for the Mexican sample, regardless of migration experience.

One of the only quantitative studies focused on return migrant health with comparisons to non-migrants or internal migrants in Mexico (as opposed to Mexican immigrants in the U.S.) is Ullmann and authors’ (2011) analysis of among young and middle-aged male respondents to the 2007 Mexican Migration Project. The authors found that return U.S. migrants had higher odds of smoking, obesity, heart disease and mental health disorders, compared to their non-migrant counterparts. The differences were likely due to acculturation to U.S. norms around smoking and higher calorie diets, or increased economic resources for return migrants that enabled purchase of tobacco and high-calorie foods. These findings remained even when controlling for limited indicators of childhood health status, meant to control for emigration health selection.

Taken together, these findings suggest that migration experience might influence some aspects of adult health relative to non-migrant counterparts in Mexico. The studies suggest that return migrant health outcomes are partially the result of experiences of migration (e.g. cumulative time in the U.S., cumulative effects of laboring and facing discrimination in the U.S.); cumulative time in the U.S. is both disadvantageous for health (de Oca et al., 2011) and associated with better self-rated health and lower odds of smoking (Riosmena et al., 2013). On the other hand, health differences are potentially the result of increased wealth, which might in turn enable greater consumption of packaged or processed foods, tobacco, or alcohol products (Ullmann et al., 2011), but also better access to health care, in addition to facilitating a sense of financial security and overall well-being (Gonzalez Vazquez et al., 2007).

There remain several deficits in the literature on the health outcomes of return migrants. For one, the quantitative studies are heavily engaged in comparisons of return migrants to their migrant counterparts who remain in the U.S. To that end, they do not examine factors in Mexico (e.g. current wealth, income, living conditions, access to health care) that might moderate or explain findings of better or worse health for return migrants. They assume that significant findings are due to the conditions of migration only (i.e. the return is motivated by poor health). In addition, these studies have not addressed depression outcomes adequately. Ullmann and authors (2011) did include a measure of self-reported ‘emotional/psychological disorders’, but it appears that this was a binary, self-report measure that might have included a wide range of disorders, as opposed to a scale representing particular symptoms of depression. Using data from a survey based in several Mexican communities focused on clinical depression and anxiety more specifically, Familiar and co-authors (2011) found significantly greater odds of depression for return migrants compared to non-migrants. Both of these studies include much younger migrant cohorts. Again, depression is the leading cause of disability in Mexico, and deserves further attention in this body of work, particularly for older adults (Berenzon et al., 2013).

Finally, the quantitative studies do not adequately address emigration selection on pre-migration characteristics. Ullmann and authors (2011) control for limited pre-migration health proxies (self-rated childhood health before 14 and adult height) in their models comparing return migrant men to their non-migrant counterparts. However, there are many other aspects of childhood socio-economic status and health that might influence both emigration selection and later-life health. Wong and authors (2007) address this kind of emigration selection bias more carefully with a propensity score matching approach in their analysis of wealth outcomes for older Mexican men, including many return migrants, but this kind of approach has not been done for health outcomes.

In addition to potential selection bias in terms of pre-migration health and socio-economic factors, there may also be important interactions between the early-life conditions and the consequences of migration to the U.S. For example, the long-term effects of poor childhood conditions on adult health and aging indicators might be attenuated for individuals who completely alter their social, economic and health-related conditions through international migration (Marmot et al., 1975). Overall, there is still a large gap in the literature on immigrants and return migrants in Mexico related to the earlier-life or life-course origins of later-life health, and the relative place of migration alongside other life-course social and economic determinants of health (Al Hazzouri, Haan, Galea, & Aiello, 2011; E. M. Crimmins, Soldo, Kim, & Alley, 2005; de Oca et al., 2011).

Two studies of the life-course origins of Latin American immigrant health have taken advantage of cross-national data sets to compare the effects of early childhood socio-economic status and health on the adult health of immigrants, return migrants and never-migrants in Mexico (Al Hazzouri et al., 2011; E. M. Crimmins et al., 2005). Crimmins and authors (2005) paired respondents from the Mexican Health and Aging Study (MHAS), a panel survey of Mexican adults 50 years and older, with data from older Mexican-origin respondents to the National Health and Nutrition Examination Survey (NHANES) in the US. They found that there were no significant differences by migration status (e.g. US-born, Mexican immigrant, return US migrants and never-migrants in Mexico) in the relationship between adult height, a proxy for childhood nutritional and health context, and a range of health outcomes. Taller height was associated with better health (i.e. lower odds of prior heart attack, better self-rated health and fewer functional limitations) in all cases, suggesting that childhood context mattered for adult health regardless of migration history.

On the other hand, Al Hazzouri and authors (2011) compared MHAS respondents to older Mexican and US-born older adults living in the Sacramento area of California (SALSA), and found that migration significantly modified the relationship between childhood socio-economic status and cognitive function. Specifically, higher parental education was associated with higher scores of cognitive function for older Mexicans who never migrated but was not consistently associated with cognitive function for return migrants, Mexican immigrants in the US, or US-born Mexican-Americans with immigrant parents. These cross-national studies provide mixed evidence for the hypothesis that immigration moderates the effect of childhood context on later life health. Further research on a range of health outcomes and study populations is necessary to assess the degree to which immigration alters the relationship between childhood context and adult health.

Collectively, these findings emphasize the persistent influence of early childhood factors, including pre-migration aspects of childhood context, in influencing a select set of health outcomes for older adults, regardless of the changes brought about by immigration. However, much more work remains in terms of examining the role of migration alongside other life-course determinants of health. For example, studies like the Mexican Health and Aging Study include a wide range of early-life socio-economic and health measures that might be used in a more extensive test of the interaction between early-life conditions and migration. In addition, these tests of the interaction between early-life conditions and mid-life experiences with migration might be extended to include the family members of migrants who have remained in Mexico but nevertheless may be affected by family and population-level trends in U.S.-Mexico migration. I turn to examine health outcomes for this group of non-migrants with U.S. migrant family members.

1.4 Literature on migration and the health of family members who stay

Mexican migration to the U.S. has potentially far reaching effects on the families and community members of migrants. Research on the effects of migration on family members who remain in Mexico has found evidence of change in a range of nutritional, infectious disease, and mental health outcomes. A great deal of this research has focused on children's health outcomes; some studies have identified a potentially beneficial relationship between remittances from migrant family members and reduced the odds of low infant birth weight and infant mortality, perhaps due to improved prenatal care and childhood nutrition (Frank, 2005; Hamilton, Villarreal, & Hummer, 2009).

More recently, this work has started to consider the potentially adverse health impacts of having migrant family members for children. For example, Creighton and authors (2011) found that children with some U.S. migrant networks in their household had significantly greater odds of becoming overweight or obese over a three-year period compared to those with no migrant networks. This relationship between migrant networks and overweight/obesity remained even after controlling for household economic status, sedentary behavior, and other household and community-level characteristics. Riosmena and co-authors (2012) suggest that findings of increased overweight/obesity in households with migrant networks, and subsequently greater risk for chronic health conditions, can be explained in part by potential changes in preferences around food, preparation, portions, and body sizes as the result of 'cultural remittances' from migrants who have spent time in U.S. food environments. However, in their study of Mexican adults, Riosmena and co-authors (2012) find more support for an association between receiving remittances and increased odds of overweight and obesity, lending support to increased purchasing power as an explanation for higher rates of overweight among family members of U.S. migrants.

A small number of studies have examined the role of family member migration on the health of older adults, with a focus on how the migration of adult children influences the health of older Mexicans through effects on financial and in-person care (F. Antman, 2010). For example, using the Mexican Health and Aging Study (MHAS) national survey data on middle-aged and older Mexican adults, Antman (2010) found that having a child in the U.S. is associated greater odds of having ever been diagnosed with a heart attack or stroke and greater odds of “poor mental health”. In a community-based, mixed-methods study of older Mexican men, González-Vasquez and authors (2007) found that Mexican men who were both migrants and had children who migrated to the U.S. had better indicators of quality of life and economic security than those who did not have the same intergenerational migration history.

Another body of literature on the effects of migration on family members who stay has focused on the health outcomes for women with spouses who migrate to the U.S., which is the focus of my dissertation. This literature has origins in qualitative research on Mexican women and their families from the 1960s onward (Dinerman, 1978, 1982; Kanaiaupuni, 1995; Mummert, 1988; Wiest, 1983). This research has documented that there are multiple, countervailing effects of spousal migration to the U.S. on women’s lives in Mexico. There are many potential stressors related to the U.S. migration of spouses, including worry and anxiety about spouses’ safety, but also the potential of infidelity or marital dissolution. In addition, women are often charged with increased burden of household responsibilities, and often assume informal or domestic work outside the home in order to support their family’s basic needs as husbands work to establish themselves in the U.S., or during periods of fewer remittances.

On the other hand, some of this research suggests that women may benefit from the international migration of their spouses. For one, they may benefit from improved social and economic standing. Particularly in the cases in which men were able to maintain consistent remittance sending to families back home in Mexico, women were less likely to work outside the home(Wiest, 1983). Given the absence of husbands and increased responsibility for their household finances, women reported experiencing a sense of freedom and increased control within their families. As Hondagneu-Sotelo writes of her Mexican immigrant women informants reflecting on their time in Mexico, before their spouses migration to the U.S. women “had always obeyed their parents or husbands, but their husbands' migration enabled them, indeed required them, to act decisively and autonomously", assuming the position of de facto head of the household and often taking on leadership roles in the broader community (Hondagneu-Sotelo, 1994, p. 65).

Only recently have studies of the impact of spousal migration to the US focused more specifically on health effects. Research has primarily focused on mental health outcomes using qualitative data (McGuire & Martin, 2007) or quantitative data with community or regional samples (Bojorquez et al., 2009; V. N. Salgado de Snyder, 1993). These studies suggest that the stress associated with familial separation and the additional roles and responsibilities assumed by women who remain in countries of origin can lead to depression, anxiety, or *ataques de nervios* (Bojorquez et al., 2009; V. N. Salgado de Snyder, 1993). For example, in ethnographic work with women in Oaxaca, Mexico, McGuire and Martin (2007) report that many women with spouses in the U.S. expressed a sense of grief or loss during the time their spouse was away, often as part of real or perceived concerns of family disintegration. This sense of loss was compounded by feelings of uncertainty or fear around the safety of their family members while crossing the border and living in the U.S., particularly if they were undocumented. In addition, women who remain in communities of origin face additional roles as the result of their spouses' migration, including the potentially dual responsibilities of raising children and providing economically for the family, at least during periods in which spouses are not sending remittances back home (V. N. Salgado de Snyder, 1993).[13]

[13] Another study (Caballero, Levya-Flores, Ochoa-Marín, Zarco, & Guerrero, 2008) based in-depth interviews with women in two Central Mexican communities report that in the absence of sufficient remittances, women who remain often take on domestic or informal work in addition

There may also be positive mental and physical health consequences of spousal migration on mental health, related to actual or expected improvements in the household economic situation or children's educational prospects due to migration (McGuire & Martin, 2007), or the potential for women's increased autonomy around personal and family economic and health-related decisions. For example, Caballero and authors (2008) found in ethnographic work that some women with spouses abroad gained greater freedom to seek out health care services, particularly related to sexual and reproductive health. However, this increased autonomy around healthcare services was only enjoyed by women who did not move in with other family members during their spouses' time in the U.S.; while these women who remained on their own may have had less social support, they had greater autonomy. On the other hand, Bojorquez and authors (2009) found no support for the idea of increased autonomy, including autonomy in family decision-making and economic autonomy among community samples of Mexican women in the states of Guerrero, Oaxaca, and Puebla, and no significant interaction between spousal migration and autonomy measures on past-week depressive symptoms.

Ullmann (2012) has extended this literature on the relationship between spousal migration to the U.S. and chronic disease outcomes in her analysis of health differences for young and middle-aged adult women in Western Mexico based on their spouses' history of U.S. migration. Ullmann found mixed evidence for differential chronic health outcomes among women with migrant and non-migrant husbands. Those who had spouses with U.S. migration

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to their roles as heads of household and work inside the home. That is, women working outside the home might be indicative of insufficient remittances or general economic strain in the family. On the other hand, in their analysis of Mexican Migration Project data, Aysa and Massey (2004) found that only urban-dwelling women with migrant spouses in the U.S. were compelled to join the labor force; spousal migration did not appear to influence the labor participation of women who remained in rural areas of Mexico.

history were more likely to report heart disease, but there were no significant differences in hypertension, diabetes, or the odds of ever smoking when comparing women with migrant spouses and those with never-migrant spouses. In line with the literature on mental health outcomes, Ullmann also found evidence that women with spouses abroad were more likely to report “emotional or psychological” problems more generally, although with no clarification on the specific kind of problems these might be. There was no ‘dose-response’ effect of male migration whereby women whose husband’s spent a greater proportion of the total time of their union abroad had worse health.[14]

Although the extant literature on depressive symptoms and chronic disease outcomes represent an important extension in the literature on the potential health impacts of spousal migration on the health of women primarily in middle adulthood, there is an additional need to understand how these findings extend into later-life, and to examine some of the factors that might explain these findings of worse or similar health. For example, there may be differences in the long-term health for women whose spouses migrated depending on whether or not women who remained in Mexico faced greater burden around childcare, whether women had jobs that might have contributed to more or less autonomy generally, or decision-making power within relationships. There may be additional differences in the relationship between spousal migration

[14] Ullmann also considered the possibility that women with migrant spouses were somehow differently selected into such unions based on their earlier life health conditions, as measured by a retrospective indicator of self-rated health status by 14 years old and adult height – a commonly used proxy of early childhood nutrition and health context. Although she found no differences on these two proxies of childhood conditions for women based on spousal migration histories, tests of other measures of childhood context (e.g. material deprivation, parental education, place of birth) and the role of women’s broader family migration histories (e.g. among siblings, parents, or children) might be included in further examination of how spousal migration contributes to health and aging amidst other life-course contributors.

and long-term chronic health incomes based on indicators of power inequities between women and their spouses, and women's general sense of autonomy (Bojorquez et al., 2009; Parrado & Flippen, 2005). The long-term impact of spousal migration history may also depend on marital status, socio-economic status, and access to health care by middle and older adulthood, moderating factors that have been described in some qualitative studies, but not examined in the few available quantitative studies.

The specific aims for my dissertation follow from my review of the trends in aging, migration, and the epidemiological profile of Mexico. After presenting my specific aims, I turn to my theoretical framework in order to generate hypotheses corresponding to each specific aim.

1.5 Specific Aims

Specific Aim 1. Estimate the relationship between personal U.S. migration history and chronic health conditions (depressive symptoms, diabetes, hypertension) for older Mexican men.

Specific Aim 1a. Compare average probabilities of diabetes, hypertension, and depression, for middle-aged and older return migrants compared to never-migrants, given similar U.S. migration propensities.

Specific Aim 1b. Estimate the relationship between U.S. migration history and diabetes, hypertension, and depression outcomes for older Mexican return migrants compared to never migrants, differentiating migrants who spent more or less cumulative time abroad.

Specific Aim 1c. Estimate the relationship between U.S. migration history and health outcomes for older Mexican men, conditional on current socio-economic status and rural or urban residence.

Specific Aim 2. Estimate the relationship between spouses' U.S. migration and older Mexican women's chronic health conditions.

Specific Aim 2a. Test the mediating effect of a history of raising children alone on the association between U.S. spousal migration and later-life diabetes, hypertension, and depression for middle-aged and older Mexican women.

Specific Aim 2b. Estimate the relationship between spouses' U.S. migration history and diabetes, hypertension, and depression outcomes for middle-aged and older Mexican women, conditional on their labor history.

Specific Aim 2c. Estimate the relationship between spouses' U.S. migration history and health outcomes for middle-aged and older Mexican women, conditional on indicators of internal locus of control, and decision-making power within their marital or consensual union relationships.

Specific Aim 3. Test U.S. migration experience (personal and family) as a moderator of the relationship between early-life conditions and later-life health chronic health outcomes for older Mexican adults.

Specific Aim 3a. Estimate the relationship between early-life socio-economic health conditions and later-life chronic health outcomes for middle-aged and older Mexican adults.

Specific Aim 3b. Estimate the relationship between early-life socio-economic and health conditions and later-life chronic health outcomes, conditional on personal migration history.

Specific Aim 3c. Estimate the relationship between early-life socio-economic and health conditions and later-life chronic health outcomes, conditional on family migration history.

Chapter 2: Theoretical Framework

In order to generate hypotheses for my specific aims, I draw on the cross-national framework for immigrant health research, introduced by Acevedo-Garcia and co-authors (2012) to better understand social determinants of immigrant health across the life-course and in cross-border contexts. I expand on several pieces of this framework, including migration selection factors, social determinants of health in sending and receiving countries, the life-course perspective, and transnationalism or cross-border ties. However, as part of this framework, Acevedo-Garcia and authors do not extensively address the theories relevant for the long-term health of return migrants, and do not consider the long-term health of family members in countries of origin. Given this omission, I additionally draw on theories linking gender and power to migration outcomes in order to address my specific aims related to the long-term health of Mexican women whose spouses may have migrated to the U.S.

2.1 Migration selection factors

In their cross-national framework for immigrant health, Acevedo-Garcia and co-authors (2012) emphasize the importance of health selection factors that may influence the decision to migrate. In particular, they refer to the commonly cited theory that immigrants are a systematically healthier sub-sample of the overall populations from their origin communities and countries. They suggest that health selection variables interact with economic and political factors in sending and receiving countries that might compel individuals (or healthier individuals) to migrate. For example, the promise of improved wages abroad might contribute to migration, although calculations about how well a labor migrant will do economically likely depend on self-assessments of his/her own health status, and the consequent likelihood of finding a job (Jasso et al., 2004). It is important to note, however, that the cross-national health framework ignores some of the family and other social network factors that may also contribute to migration selection. Health selection is only one factor contributing to migration from Mexico to the U.S., and return back to Mexico (D.S. Massey et al., 1993; Van Hook & Zhang, 2011). Other factors that may have a strong influence on migration include the previous migration of other individuals in extended family or community networks. These migrant contacts may facilitate migration itself, and provide access to jobs, housing, and other resources once abroad (D.S. Massey et al., 1993). Comparisons of later-life health for return migrants versus non-migrants should take the potential differences in pre-migration, earlier life health and other migration selection factors into account. For example, it may be that the adverse effects of U.S. migration experience on later-life health are suppressed without controlling for the better pre-migration health or economic conditions of U.S. return migrants.

2.2 Social and economic determinants of health

The cross-national framework for immigrant health draws heavily on the idea of social determinants of health. The social determinants model emphasizes the role of social conditions, or "factors that involve a person's relationships to other people", in structuring individual health outcomes and population health disparities (Link & Phelan, 1995, p. 81). These relationships might take place within the structure of the family, or within broader social, economic, and political structures. Socio-economic status in particular has been conceived of as a social determinant of health that is also a 'fundamental cause' of disease (Diez Roux, 2012; Link & Phelan, 1995). In particular, individuals with higher socio-economic status have greater access to resources like health care, health information, higher quality food and housing, and influential social contacts that allow them to avoid health-related risks. On the other hand, chronic stress resulting from both conditions of poverty and lower relative socio-economic standing can contribute to physiological ‘wear and tear’ or ‘allostatic load’, in turn elevating risk for chronic disease onset and mental health disorders (Gruenewald et al., 2012; McEwen & Seeman, 1999).

International migration has been largely absent from the discussion of social determinants of health, or fundamental causes of disease more specifically, until recently (Acevedo-Garcia et al., 2012; Viruell-Fuentes, 2007). International migration can lead to dramatic shifts in individual social positions within families, communities, and the larger social, economic and political structures of sending and receiving societies, which might challenge the idea of stability in the social determinants model (Link & Phelan, 1995). There may be ‘new’ social determinants of health relevant for immigrants in the receiving context (e.g. discrimination, occupational risks) that may structure multiple health risks and multiple health outcomes (Acevedo-Garcia et al., 2012). Changes to immigrant social positions potentially lead to new risks and resources in the reception context, including poor access to health care, occupational exploitation, and chronic stress resulting from discrimination, fears of deportation, the stress of adaptation, and/or family cultural conflicts (Viruell-Fuentes, 2007). In addition, exposure to distinct physical and food environments in the U.S. might contribute to more sedentary lifestyles and higher consumption of sodium, sugar, and fat, which may contribute to increase risk for hypertension and diabetes (Handley et al., 2013; Riosmena et al., 2012). Within this context, more prolonged exposure to the risks related to living as an immigrant in the U.S. likely leads to poorer chronic and mental health outcomes later in life.

On the other hand, the potential for immigrants to improve their socio-economic status relative to those in their sending communities may lead to a change in the resources they have to anticipate health risks and manage their consequences through better access to health care (Link

& Phelan, 1995). These changed socio-economic resources relevant for health may only present themselves once migrants have returned back to their sending communities. Once back in sending communities in Mexico, return migrants from the U.S. may perceive themselves as having relative economic stability, improved relative social standing, and more resources around chronic disease management (Alarcón, 1988; Gonzalez Vazquez et al., 2007; López Castro, 1986; Salinas, 2008). Upward socio-economic mobility is also generally associated with improved health outcomes in part due to the potential psychological benefits of relatively improved socio-economic status (Gruenewald et al., 2012), and stress-mitigating feelings of greater self-esteem or sense of control over one's life chances, or mastery.[15] There are still likely some countervailing effects of improved socio-economic status (e.g. wealth, household conditions, perceived social standing) on these later-life health outcomes for older return migrants relative to those with no U.S. migration experience. For example, while those with more economic resources might have greater access to preventive healthcare or information about health risks, they may also have relatively greater ability to purchase tobacco or alcohol products, or processed foods, and may be more likely to afford more sedentary lifestyles (Riosmena et al., 2012). This is a common explanation for the 'reverse' social gradient found observed in areas of Mexico.

Taking into account the role of emigration selection, the largely adverse health exposures associated with working as an immigrant in the U.S., and shifting socio-economic determinants

[15] Although a recent study comparing pre and post-migration socio-economic mobility for Latino immigrants in the US found mixed evidence for this claim (Alcántara, Chen, & Alegria, 2014). Upward socio-economic mobility (i.e. better current socio-economic standing relative to pre-migration) was not associated with self-rated physical health, and was associated with lower odds of major depressive episode for Cuban immigrants, but not Mexican or other Latino immigrants, or Puerto Rican-born migrants. Downward socio-economic mobility appeared to be a more robust predictor of post-migration physical and mental health.

of health for international migrants, I lay out three main hypotheses related to my first specific aim. For one, I hypothesize that older Mexican men with U.S. migration history will have *higher* probabilities of diabetes and hypertension and higher mean depressive symptoms compared to their non U.S.-migrant counterparts (higher average treatment effects) given similar propensities to migration, or similar factors relevant for migration selection. Second, given the potentially adverse effects of long-term exposure to the U.S., I hypothesize that longer stays in the U.S. will be associated with poorer later-life chronic disease and mental health outcomes, all else equal.

Finally, due to the fact that return migrant health outcomes are often closely linked to their current socio-economic status, given potential for shifts in absolute and relative socio-economic status for those with return U.S. migration experience, I also hypothesize that the health outcomes for older Mexican return migrant men compared to non-migrant counterparts will be conditional on current indicators of socio-economic status. I expect that overall those return migrants with higher socio-economic status, based on self-assessments and reports of income and wealth, will have lower probabilities of diabetes, hypertension, and fewer past-week depressive symptoms compared to their non-migrant counterparts with lower socio-economic status. However, given the uneven epidemiological transition in rural or urban areas, I expect that the conditional effect of migration on health outcomes given socio-economic status indicators may additionally depend on respondents current region of residence; improved socio-economic status might be a health risk factor in rural areas of Mexico.

2.3 Transnationalism and gendered geographies of power

Although the cross-border framework on immigrant health references theories of transnationalism, it provides no direction for how to understand the influences of U.S. migration experience on the long-term health outcomes of those who remain in communities of origin.

Transnationalism refers to the “political, economic, social and cultural processes that extend beyond the borders of a particular state, include actors that are not states, but are shaped by the policies and institutional practices of states” (Glick-Schiller, 1999). Of specific relevance to my dissertation is the idea that families may extend temporarily or permanently across nation-state borders. Family members across borders may be engaged in economic exchanges, cultural practices, and social relationships that include caregiving, social support, and compliance with familial obligations (McKenzie & Menjívar, 2011; Viruell-Fuentes & Schulz, 2009). Shifts in lifestyle or dietary preferences, changes in family level purchasing power, and resources around chronic disease prevention and management as the result of migration to the U.S. might extend to family members, including those who never migrate, through economic or social remittances (Creighton et al., 2011; Riosmena et al., 2012). In addition, family separation across borders can very often involve experiences related to actual or potential family dissolution and feelings of worry and grief (Frank & Wildsmith, 2005; McGuire & Martin, 2007). These family strains over time may contribute to chronic stress burden, which may potentially elevate the risk of depressive symptoms, hypertension, and diabetes.

Attention to cross-border family ties and later-life health also needs to take into consideration the role of gender and the family in structuring transnational processes and the health outcomes of these processes. Levitt and Jaworsky (2007, p. 137) suggest that “family networks that cross borders are characterized by gendered differences in power and status” (p. 137). Mahler and Pessar (2001) propose the idea of gendered geographies of power to explain the way in which gender structures migration, and how migration may both change and reinforce traditional gender relationships and inequalities. Migration may lead to changes in gender hierarchies, but may also reinforce traditional, gendered divisions of labor and power as migrants encounter new social locations in the reception context while continue to operate within the gendered context of their country of origin.

Parrado and Flippen (2005) suggest that change in gender relations due to migration be viewed in the context of three domains -- labor, power, and cathexis, or the attachment of emotional ideas or feelings to ideas, objects, or people – rather than evaluated as either a complete shift or complete stasis in gender inequality. With change potentially taking place across these three domains, it’s possible to imagine that family-member migration might influence the health of some non-migrants more than others, and in different directions, based on personal conditions of labor (e.g. paid or not; public, in the home, or both), power or control over decision-making, and individual ways of defining the roles of men and women in romantic and familial relationships (Mummert, 2012).

For example, if a woman is able to improve her socio-economic standing and increase control over family finances by working outside the home, there may be some beneficial effects of spousal migration on health, including health in the long run (Bojorquez et al., 2009; Caballero et al., 2008; Hondagneu-Sotelo, 1994; Mummert, 1988). Working outside the home may afford women more control over earned income, or may facilitate the development of social networks outside the home that may help buffer the effects of stressful life events on health (Parrado, Flippen, & McQuiston, 2005). On the other hand, the social and economic gender hierarchies that existed pre-migration may become reinforced and may be made even more rigid as families are spread across borders if women who stay behind are prevented from gaining more egalitarian footing through entry into paid labor force or further dependency on their spouse’s increased earnings, sent home in the form of remittances (McKenzie & Menjívar, 2011; Wiest, 1983). In addition, even women who gain employment outside the home as the result of migration likely have a double burden of formal employment and childcare (Caballero et al., 2008; Dinerman, 1982). Finally, women employed as domestic workers may face a dual burden of reproductive labor in the home and in the work day, in addition to being faced directly with class hierarchies that allow for the outsourcing of domestic work from wealthier to poorer women, which may be associated with a decreased sense of personal control or other psychological coping resources to mitigate the health effects of job strain, family strain, and other stressful life events (Salazar Parrenas, 2000).

. With reference to my second study aim, I hypothesize that on balance spouses' U.S. migration will be associated with higher probabilities of diabetes, hypertension, and more past-week depressive symptoms for middle-aged and older Mexican women, compared to those whose spouses never migrated. Given the theoretical framework related to gender and power in migration outcomes, I hypothesize that the adverse effect of spouses' U.S. migration history on chronic disease and depression outcomes for middle-aged and older Mexican women will be explained in part by also having a history of raising children on their own. I additionally expect that the association between spousal migration to the U.S. on later-life health will be conditional on occupational histories of unpaid work or domestic work outside the home. For middle-aged and older Mexican women, the adverse effect of spouses' migration history on chronic disease and depression outcomes may be buffered by a history of getting paid for their own labor, and by work in higher-status occupations (e.g. service, professional) for pay.

With reference to the dimension of power or decision-making raised (Parrado et al., 2005), I also expect that the effect of spouses' migration history on chronic health conditions will be exacerbated for 1) respondents with lower scores on a scale of internal locus of control and 2) lower self-assessed decision-making power relative to their spouses (for currently married respondents only). Alternately, the adverse effect of spouses migration history on chronic health conditions will be buffered or diminished for 1) respondents with higher scores on a scale of internal locus of control and 2) higher self-assessed decision-making power relative to their spouses. High perceived personal control or mastery can additionally be thought of as a psychological resource that may buffer the deleterious health effects of stress, including family and job strain (Gallo et al., 2007; Pudrovska, Schieman, Pearlin, & Nguyen, 2005).[16]

2.4 The life-course perspective

The final theoretical piece of the cross-national framework builds on the life-course perspective. The life-course perspective draws attention to the way that individual lives unfold according to individual development and age-specific patterns, which are in turn shaped by aspects of time and place, including historical context, social and political institutions, and social change. The life-course perspective also draws attention to the timing of exposures and events as well to transitions or changes in individual status and roles along the life-course (Elder, Johnson, & Crosnoe, 2003). These two concepts are closely linked, as the influence of transitions on health may depend in large part on their timing relative to age-specific norms or 'critical' periods in human development.

The public health literature has drawn on the life-course perspective to suggest that social, economic, and environmental conditions earlier in the life-course, and as early as *in utero*, have far-reaching effects on health in mid to late-life (Hertzman & Boyce, 2010). These long-term effects might take place through direct or 'latent' mechanisms that link early exposures to

[16] There are no measures available in my dataset that would allow for conditioning the effects of spousal migration on later-life chronic disease and depression outcomes on individual respondents' ideas or meanings attached to gender roles – the third domain raised by Parrado and Flippen (2005).

later-life health. For example, Barker and his colleagues (1997; 1993) have suggested that poor maternal nutrition and health in the 'critical' gestational period might lead to impaired development of infant blood vessels, the heart and other organs, which in turn contributes to higher blood pressure in adulthood. Poor fetal nutrition may also contribute to insulin-resistance susceptibility later in life, leading to increased risk of diabetes and cardiovascular disease. Recent expansions on the Barker hypothesis have pointed to early childhood more generally as a 'critical' period in which stressful conditions and events adversely influence cognitive development and increase cortisol production, in a process of 'biological embedding'. These 'embedded' experiences might have lasting direct effects on adult health, regardless of intervening circumstances, by affecting brain and organ development and conditioning biological responses to stress (Hertzman & Boyce, 2010).

Early life exposures may also influence later-life health through indirect 'pathways', by influencing intervening health and socio-economic conditions (Best et al., 2005; Hertzman & Boyce, 2010; Luo & Waite, 2005; O'Rand & Hamil-Luker, 2005). For example, low childhood socio-economic status might contribute to a 'pathway' of lower educational attainment by reducing chances for early cognitive and skill development, or necessitating early entry into the labor market and early exit from school. Lower educational attainment in turn limits chances of upward socio-economic mobility, and increases the likelihood of ending up in lower paying and physically demanding jobs with adverse consequences for health. Poor childhood health may also lead to a path of lower socio-economic attainment in adulthood by increasing the number of missed school or workdays, or necessitating early exit from the labor market, in turn reducing lifetime earnings and accumulated wealth.

There has been limited integration of the life-course perspective with theories of migrant health, including the health of return migrants and their family members (de Oca et al., 2011; Gong, Xu, Fujishiro, & Takeuchi, 2011; Jasso, 2003; Miller-Martinez & Wallace, 2007). This deficit may be due to the fact that the predominant theories of acculturation and acculturative-related stress are largely focused on behaviors, exposures, and outcomes within the reception context, and rarely reference early life exposures that may have occurred pre-migration. A life-course approach to immigrant health might examine how conditions of migrants' early lives, including gestational and childhood exposures and events, continue to influence chronic health conditions and mental health outcomes regardless of intervening experiences with migration (Acevedo-Garcia et al., 2012). If some of these earlier life conditions have become biologically 'embedded', they may continue to have direct or 'latent' effects on health, as well as the timing of health outcomes and the speed of aging, regardless of intervening events like migration and return migration.

On the other hand, the life-course perspective would also accommodate the idea that migration may moderate or alter the relationship between early childhood conditions and later-life health for older adults (Al Hazzouri et al., 2011; Gruenewald et al., 2012; Luo & Waite, 2005). For example, upward mobility achieved as the result of migration might attenuate the relationship between early childhood conditions and later-life health if return migrants are able to accrue greater assets relative to their non-migrant counterparts who lived through similar environmental and educational circumstances (V.N. Salgado de Snyder, 2007; Wong et al., 2007). Greater economic resources as the result of migration and, potentially, the migration of family members who remit money back home, may allow immigrants, return migrants, and non-migrant family members better access to higher quality health care and may elevate social standing in communities of origin (Gonzalez Vazquez et al., 2007). It is also possible that migration experiences might exacerbate, rather than mitigate, the influence of adverse childhood conditions on later-life health for return migrants and their family members if improved purchasing power enables consumption of more high-calorie foods, alcohol, or tobacco as compared to what we would expect for non-migrants with similar childhood socio-economic conditions (Ullmann et al., 2011).

The final life-course concept I will review is the idea of cumulative effects, which also been used to explain how prolonged periods of exposure to adverse conditions generally add up across one's life to generate population inequalities in later-life health (Ferraro & Shippee, 2009; Gruenewald et al., 2012; O'Rand, 1996). The cumulative effects concept suggests that the *amount* of exposure, or the cumulative sum of this exposure, also contributes to disparities in health later on. For example, by older adulthood, some individuals may have acquired a life's worth of economic disadvantage including low levels of education, poor material resources, poverty-related stressors, and little access to health care that may have adverse impacts on chronic disease and mental health outcomes (Gruenewald et al., 2012; O'Rand & Hamil-Luker, 2005).

The concept of cumulative effects is another useful component of the life-course perspective that might be applied to immigrant health and help explain long-term effects of migration on health (de Oca et al., 2011). Long periods of exposure to immigration-related stress, including discrimination and legal status stressors related to immigration status, and even the kinds of stressors described by the concept of acculturative stress, might have an adverse influence on chronic health conditions even long after return migration (Myers & Hwang, 2004). While the body's response to stress in the short term may be protective, chronic arousal of physiological response systems due to prolonged periods of immigration-related hardship can lead to increased allostatic load, or physical wear and tear (Kaestner, Pearson, Keene, & Geronimus, 2009). For example, prolonged periods of high blood pressure and increased cortisol production, both physiological indicators, may lead to hypertension and other indicators of cardiovascular disease (e.g. heart attack and stroke) and the onset of diabetes. More directly related to the concept of acculturation, a prolonged period of increased substance use or poorer diet for immigrants in the U.S. may also have an influence on later-life health, including the onset of mental health and chronic health conditions and aging trajectories (Angel, Buckley, & Sakamoto, 2001). The concept of cumulative effects supports a hypothesis of poorer health outcomes for return migrants who spent longer periods of time in the U.S. (cumulative time abroad), but better health outcomes for return migrants with more cumulative time living in Mexico since returning from the U.S.

For my third specific aim, I draw on the idea of both latent and pathway mechanisms described in life-course epidemiology. In particular, I expect that for a sample of middle-aged and older Mexican adults, higher levels of early-life socio-economic disadvantage (i.e. lower levels of parental educational attainment) and poorer childhood sanitation and health contexts will be associated with higher probabilities of later-life diabetes, hypertension, and depression. I expect that part of this effect will be mediated or “explained” by mid-life or current socio-economic and health conditions, including personal or spousal migration to the U.S., indicative of a pathway mechanism. I also expect, however, a residual, direct association between early-life socio-economic status and health conditions and later-life chronic disease and depression outcomes (latent effects). I expect these results to hold for all groups, regardless of personal or family U.S. migration experience.

However, given the potential for international migration to alter the relationship the life-course socio-economic and health trajectories, I expect the association between early-life socio-economic status and health conditions and later-life health outcomes to be weaker for return migrants compared to their non-migrant counterparts. I expected to see a similarly attenuated relationship between childhood conditions and later-life health outcomes for non-migrants with migrant family members compared to those with no migrant family members. On the other hand, if there is no differential association between childhood socio-economic and health conditions with later-life health by migration history, this might lend support to the idea of the persistent health effects of early-life exposures regardless of intervening conditions.

In summary, my theoretical framework brings together key concepts from the cross-national framework of immigrant health – migration selection, social determinants of health in both receiving and sending contexts, cross-border ties, and the life-course perspective. However, I expand on the cross-national framework for immigrant health to be more applicable to the health outcomes of return migrants and family members of migrants to the U.S. who may or may not migrate themselves. To that end, I have incorporated theories of gender and power in migration outcomes. In Figure 2.1, I present a conceptual framework that brings together these theoretical perspectives to be applied to my analysis of diabetes, hypertension, and depression outcomes among middle-aged and older adults in Mexico. I have highlighted in bold the elements that I have expanded, given the components of Acevedo-Garcia and co-authors' (2012) original framework.

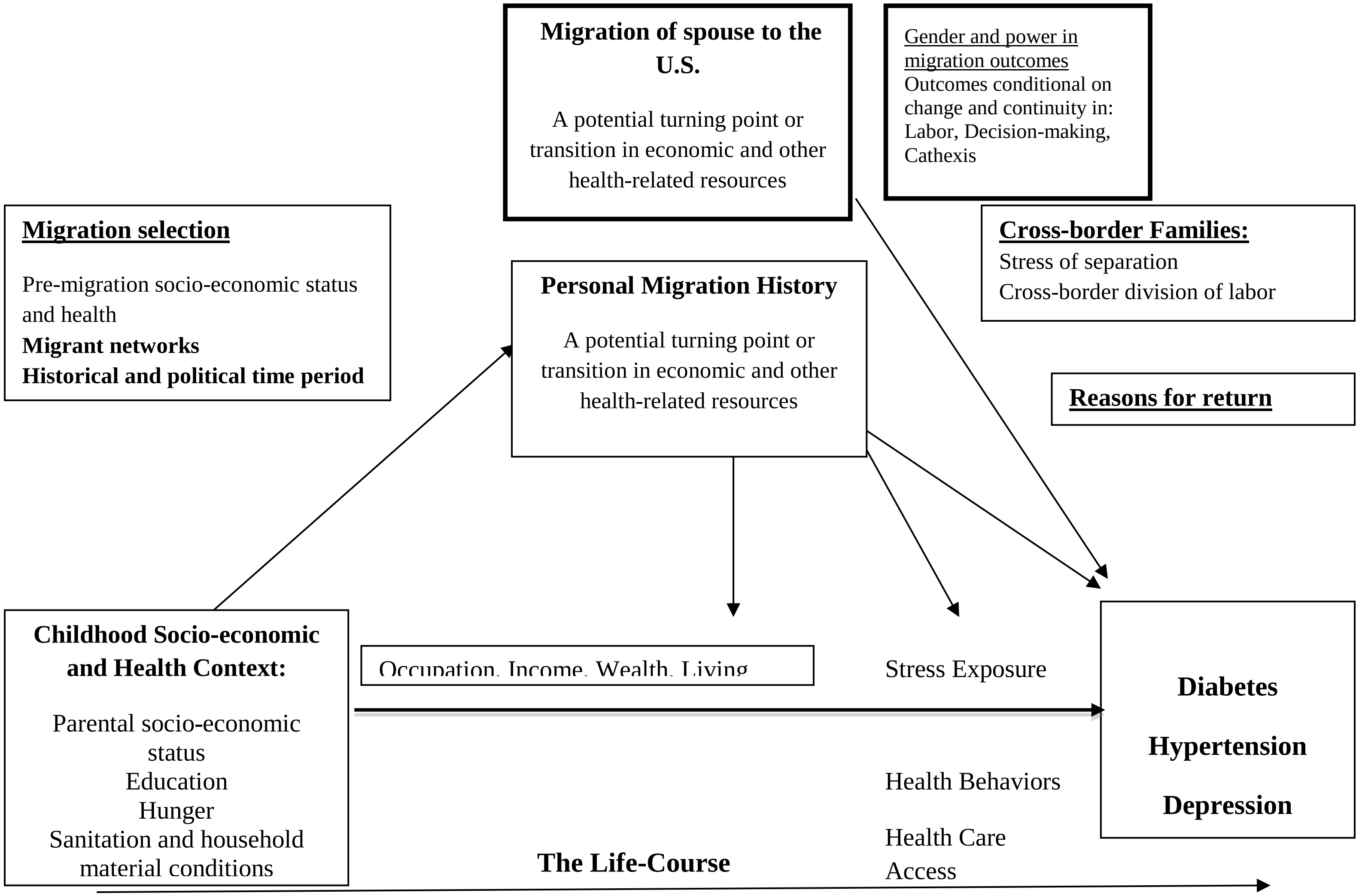

Figure 2.1. An expanded cross-national framework for the later-life health of return migrants and family members of

Chapter 3: Methods

3.1 Data

Data for this analysis comes from the Mexican Health and Aging Study (MHAS), a nationally representative panel survey of adults living in Mexico who were born before 1951. The objective of the MHAS was in part to understand the role of migration, including family member migration, on the health and aging indicators of middle-aged and older Mexican adults. The MHAS includes extensive measures on health and health services, family composition, caregiving and monetary transfers, as well as personal and family migration history (Wong, Pelaez, Palloni, & Markides, 2006). Baseline MHAS interviews were conducted in 2001; a second wave was conducted in 2003.[17] In the analyses of early life influences on later-life health in particular, I run analyses using both waves of data given that some early life indicators were added in 2003.

The MHAS selected households with adults 50 years and older that were previously included in the nationally representative 2000 Mexican Employment Survey (ENE-2000) (Wong & Espinoza, 2004). Based on the pool of potential respondents, the MHAS used a multistage area probability sample, stratifying by two Mexican regions consisting of: 1) six states with high rates of out-migration to the United States and 2) the remaining 26 states and the Federal District of Mexico. Households in heavy out-migration states (Durango, Guanajuato, Jalisco, Michoacán, Nayarit and Zacatecas) were oversampled relative to households in the remaining states[18]. Specifically, the quota of households set for the six high out-migration states represented 27% of

[17] A third wave was completed in 2012, although public use data is not yet available.
[18] Based on out-migration data from 1995. Guanajuato, Jalisco, and Michoacán were the most prominent sending regions throughout 20th Century U.S.-Mexico migration history, although the remaining three states are also considered part of the 'historic sending region' of Western Mexico (Durand et al., 2001).

the intended sample (or 3,000 households for a total target of 11,000 households) whereas 73% of households (5,000) were to be surveyed in the remaining states.

At the household level, each adult 50 years or older had an equal probability of being selected, proportionate to the number of age-eligible adults in the household. Spouses or cohabitating partners were also interviewed regardless of age. Proxy interviews were completed for respondents who could not answer directly due to severe health problems, cognitive impairment, and language difficulties (e.g. non-Spanish speakers), or prolonged (but temporary) absences. Next-of-kin interview were conducted on subjects who had died by the follow-up visit.

The MHAS had a baseline response rate of 89.7% and collected data from a total of 15,156 respondents, spouses and proxy respondents in 2001. I excluded 1032 proxy respondents from my analytic sample given their limited responses on key measures in my models (i.e. childhood conditions, depressive symptoms).[19] I also excluded 1669 spouses that were younger than 50 years old at baseline. After excluding proxy respondent interviews and non age-eligible spouses, I was left with a baseline sample of 12,455 age-eligible direct respondents and spouses.

[19] The exclusion of proxy interviews may bias the sample towards healthier individuals with more education, given that health and language difficulties were primary reasons for interviewing a proxy. In addition, while long-term care facilities are rare in Mexico relative to the US, a growing number of older adults make use of these facilities and would not be represented in this study (Wong et al., 2006). This may skew the MHAS sample towards younger adults with better physical, mental and cognitive health indicators. On the other hand, Wong and Espinoza (2004) compared baseline sample characteristics for the MHAS to responses to other household surveys (National Health Survey, the National Income and Expenditures Survey, and the National Employment Survey, all fielded in 2000) and the 2000 Mexican Census to test the validity of the sample. They found that MHAS respondents were comparable to respondents to the Census and other national surveys on distributions of age, gender, educational, marital status, literacy and number of children. Distributions of responses on average height, body mass index, self-rated health, doctor-diagnosed diabetes, hypertension, and current smoking and alcohol use were comparable between MHAS respondents and respondents 50 years and older to the National Health Survey.

The individual-level non-response rate for all respondents was 6.7% at the two-year follow up in 2003. Of those 12,455 age-eligible, non-proxy respondents who completed 2001, 10,438 completed non-proxy interviews in 2003. Among those who are not included in this "panel" sample, 136 respondents were lost to follow-up, 546 respondents were deceased and completed by next-of-kin, and the remainder were completed by proxy respondents or were spouses replaced by new spouses in 2003.

For my dissertation, included both respondents and spouses 50 years and older in the sample in order to increase the number of return migrants available in the analysis. Given the inclusion of members of the same household in cases where age-eligible spouses are included, any of my analyses that include both men and women (e.g. in Specific Aim 3) specified a "clustering" option to take into account the correlated nature of data from respondents in the same households. The clustering option adjusts the standard errors to account for the intraclass correlation, producing clustered robust standard errors. The clustering adjustment inflates the standard errors, which might otherwise be underestimated without taking into account the correlated nature of data from similar household members. However, I almost did not use this clustering option given that I ended up stratifying the analyses by gender across all models.

An additional consideration for the analysis plan is the weighting of the data according to sample selection criteria. There are weights available in the MHAS dataset that take into account the probability of respondent selection given residence in an urban or rural area, and in a high out-migration state or not. The weights also take into account the differential probability of selection for respondents with and without an age-eligible spouse in the household; those with a spouse 50 years and older in the same household had their probability of selection as the target respondent at the household level divided in half. These probability weights can be used in weighted simple analysis[20], but are redundant in multivariable analyses that control for the same variables that were used to construct the probability weights themselves (i.e. urban/rural residence, high out-migration state residence, gender, age, marital status).

3.2 Measures

Dependent Variables

The outcome measures for my dissertation include self-report measures of doctor-diagnosed diabetes and hypertension, respectively. Specifically, respondents were asked, "has a doctor or medical personnel ever told you that you have diabetes or a high blood sugar level?" and "has a doctor or medical personnel ever told you that have hypertension or high blood pressure?" Respondents answered either 'yes' or 'no', although a total of 242 respondents from my analytic sample reported never visiting a doctor or medical personnel as of 2001. Another 28 were missing data on hypertension and diabetes. Respondents were not asked if they never visited a doctor at follow-up in 2003, although 27 were missing data on the measure of hypertension, and 43 were missing on the measure of diabetes, which may include respondents who had no medical care history.

The validity of these doctor-diagnosed measures is a concern, given that affirmative answers may be just as reflective of access to health care as they are actual medical conditions. In addition to the small number of respondents who reported never visiting a doctor, n=3624 (about 35%) respondents had not had a past-year doctor's visit in 2001 and n=3420 respondents (33%) had not had a past-year doctor's visit in 2003. About 17% of respondents in my analytic

[20] Throughout the dissertation I use the word 'simple ' to denote equations with a single predictor variable – what one might expect to see as 'bivariate'. Multivariable denotes equations with multiple predictor variables. This is based on recent clarifications in the American Journal of Public Health describing statistical models in public health research (Hidalgo & Goodman, 2013).

sample reported no past-year doctor's visit at each wave (n=1766), a group at potentially high risk for under-reporting doctor-diagnosed conditions. In addition, 3366 of respondents did not receive a test for diabetes in the past two years, which amounts to nearly 40% of those who reported never being diagnosed with diabetes. Similarly, 2149 of respondents reported not receiving a test for hypertension in the past two years, which amounts to 35% of those reporting no diagnosis of hypertension or high blood pressure.

Given the potential underestimates of doctor-diagnosed conditions, I carried out a sensitivity analysis in which I re-ran models for hypertension and diabetes but restricted my sample to respondents who had recent tests for diabetes or hypertension, respectively. I additionally re-ran models restricted to respondents with a usual source of care, or health insurance coverage, respectively. I expect that reports of doctor-diagnosed conditions will be more reliable for respondents who have access to health care, or who have actually had a recent test for these conditions. The results of the sensitivity analyses are reported in **Appendix A**.

The third dependent variable is a measure of past-week depressive symptoms using an adapted, 9-item version of the Centers for Epidemiological Studies – Depression (CES-D) scale. Versions of the CES-D scale, including the 9-item version used in the MHAS, have been validated for use among older adult populations in Mexico (Aguilar-Navarro, Fuentes-Cantú, Ávila-Funes, & García-Mayo, 2007; Sánchez-García et al., 2008). For the scale, respondents were asked to indicate if for the majority of the past week they felt the following: depressed, lonely, sad, tired, that everything they did was an effort, or that their sleep was restless. An additional three positively worded items were included: whether respondents felt happy, enjoyed life, or felt they had a lot of energy. Each item originally had a response code of 1 for a "yes" and 0 for a "no" answer. The three positively worded items were reverse coded and all of the items were summed such that higher scores indicated more depression-related feelings. The scale has a reliability coefficient of $\alpha = 0.80$ for this sample.

In my analyses I utilize a binary measure of five or more past-week depressive symptoms as a proxy for clinical depression. This cut-off point was suggested based on the validation study by Aguilar-Navarro and co-authors, (2007), based on their validation study with a sample of geriatric clinical patients in Mexico City. After comparing scores on the 9-item CES-D scale to clinician diagnoses of major depressive disorder using the criteria from the Diagnostic and Statistical Manual, Fourth Edition (DSM-IV), the authors found that a cut-off of five points maximizes both the sensitivity –the ability of the CES-D to suggest clinical depression given a positive clinical diagnosis using the DSM-IV, and specificity—or the ability of the CES-D cut-off to detect negative cases given a true negative clinical diagnosis of depressive disorder using the DSM-IV. In particular, the sensitivity estimated for the 5-point cut-off was 85.3% and the specificity was 56.7% (Aguilar-Navarro et al., 2007).

Key Independent Variables

Personal Migration History

Personal migration history is informed by two questions asked of MHAS respondents. The first asked respondents where they moved the first time they left their parental home, with options of 1) urban or 2) rural areas within Mexico, 3) the U.S., 4) another country, or 5) never left the parental home. Respondents who answered they first moved to the U.S. were combined with respondents answering 'yes' to a second, more direct question, "Not counting vacations and short visits, have you ever worked or lived in the U.S.?", to create the a sub-group with some U.S. migration experience.

With regards to cumulative time, respondents were asked about how many total years they lived or worked in the U.S. I tested this as a continuous measure, but report my analyses using a binary variable with a cut-off of 5 or fewer years compared to those who spent more than 5 years abroad. This cut-off happens to be at the mean number of cumulative years. However, it corresponds to empirical studies that have found that return migrants are more likely to have spent five or fewer years abroad compared to Mexican migrants who stay in the U.S. (Masferrer & Roberts, 2012). The MHAS also includes measures that allow for assessment of time since last return to Mexico, individual timing of migration, historical timing of migration, and whether or not respondents one or more than one trip abroad. I do not have the return migrant sample size to assess these effects at the same time that I differentiate by cumulative time in the U.S. However, I run additional analyses testing the potential differences in health outcomes for return migrants compared to non-migrants, based on these measures related to time, timing, and number of trips. For the missing values (summarized in part in Table 4, below), I propose to use a full information maximum likelihood approach, which I describe in further detail below. While there are a small number of missing cases on the migration history variable generally (24 male respondents), there are more missing for the specific recall measures of years of emigration and return.

Family Migration History

Respondents were asked about the U.S. migration history of nearly all of their family members. Most importantly for my Specific Aim 2, in 2001 respondents who were not married at the time of the survey were asked if, not counting vacations or short trips, if their spouse/partner ever lived in the U.S., with response codes of “yes” and “no”. If they were married or in a union, then I inferred spousal migration status from linked spouse files. That is, if a married respondent's spouse indicated that he was a US return migrant, then that respondent was indicated as having a spouse who migrated to the US.

The migration history of other family members may provide important information about the selection of respondents into migration. For example, I expect that respondents with parents who ever migrated to the U.S. are more likely to have had U.S. migration experience, amounting to an important factor for selection into migration. Respondents were asked if their mother and father, respectively, ever worked or lived in the U.S., with yes/no response categories. A total of 403 (3.9%) respondents in my analytic sample had 'refused' or 'don't know' answers for their father's migration history and 221 (2.2%) had 'refused' or 'don't know' answers for their mother's migration history. Respondents also indicated, not counting vacations and short visits, whether any of their siblings ever lived or worked in the U.S. As with the other migration variables, there are a high number of missing on the sibling migration, with 302 respondents (3.0% of the analytic sample with siblings) refusing to respond and 167 (1.7%) giving a 'don't know' response. In order to retain analytical power, I combined the indicators of parental and sibling migration into a binary indicator of whether or not members from respondents' family of origin migrated to the US or not.

Finally, respondents indicated whether or not their children ever lived or worked in the U.S., and if they currently live and work in the U.S. While adult child migration is not the focus of my dissertation, it may be an important predictor of later-life health outcomes, including mental health outcomes, given the potential influence of child migration on economic and material conditions, access to health care resources and technologies, exposure U.S. norms around health behaviors, and availability of caregiving (F. M. Antman, 2012; Gonzalez Vazquez et al., 2007; Salinas, 2008). For each non-resident child, respondents indicated where their child lived currently, with possible responses of ‘same house or building’, ‘same locality or neighborhood’, ‘same city’, ‘other city in Mexico’, ‘U.S.’, or ‘other country’. Those indicating ‘U.S.’ will be categorized as having a child *currently* living in the U.S. For all children, resident and non-resident, respondents also indicated whether, not counting vacations or short visits, their child ever lived or worked in the U.S. While these questions are asked of each child, I collapsed the child responses to indicate whether or not any of the respondents children ever or current live or work in the U.S.

Early Life Conditions

The MHAS includes several retrospective measures of early life socio-economic, health, and nutritional context that may serve as important predictors of later-life health for my Specific Aim 3. I additionally considered these measures as potential predictors of personal U.S. migration history, or selection factors, as part of Specific Aim 1a. Three of these measures refer to parents’ educational attainment (for mothers and fathers, respectively), and father’s occupational status. These measures are intended to indicate family-level socio-economic status during respondents’ childhood, and are potential proxies for developmental and health-related resources available to respondents from the gestational period onward (Chittleborough, Baum, Taylor, & Hiller, 2006). In both the 2001 and 2003 waves of the MHAS, respondents indicate the final level of school their mother and father each completed, with possible categories of no education, some elementary, completed elementary, and more than elementary. Given that around half of respondents reported no education for each of their parents, I collapsed these categories into “no” versus “any” education. Around 10% of non-proxy respondents did not know their parents education. I considered ‘don’t know’ as its own category in a three-category measure of mother’s education, including the potential for this response to be a marker of parental absence or early death – in which case not knowing may be a unique predictor of health and left alone as a response category. In 2003 respondents were also asked about their father's primary occupation, with possible response categories of agriculture, construction, gardening/maintenance/service, restaurant/store/hotel, professional/office, no work history, no father, and refused or don't know. Only about 2% of the total 2003 sample reported not knowing their father's occupation in contrast to the education measure.

In addition to these parental SES measures, respondents answered questions about the material conditions in their household. These measures may be better at indicating respondents' exposure to more or less advantageous material and health conditions since socio-economic resources as indicated by parental education or occupation may not have been evenly distributed within respondents' households depending on gender preferences or number of siblings (UNICEF, 2011) . In the 2001 study, respondents indicated whether or not before age 10 they had sanitation facilities in their household. In 2003 respondents answered additional questions, including whether before age 10 they: had sanitation facilities *inside* their house, somewhat analogous to the 2001 question; whether they often went to bed hungry; wore shoes or other footwear regularly; whether they or any of their siblings had to drop out of school to help their parents; whether they or their family members slept in the same room used for cooking, potentially an indicator of overcrowding, or; whether they or their family received help from family members because of economic problems.

Finally, in 2001, respondents indicated their childhood health conditions by answering whether before age 10 they had a serious health condition that left them unable to complete normal activities for a month or more, and whether they had any of the following illnesses as a child: tuberculosis, rheumatic fever, polio, typhoid fever, or a serious blow to the head that caused fainting. Each of these measures has binary, yes/no response categories and I will test them each as discrete predictors of current health outcomes.

One potential concern with these measures of early life conditions is that there is a great deal of response bias, either due to poor recall, or the anchoring of early-life memories within current socio-economic and health contexts. That is, respondents' recollections of childhood health or socio-economic conditions might be shaped by their current physical or emotional health, or socio-economic status. Haas (2007) analyzed the reliability of retrospective childhood health measures across two waves of data for middle-aged respondents to the PSID and older adult respondents to the Health and Retirement Study (HRS), respectively. He found that reports of self-rated childhood health were fairly consistent over a two-year period, although discordant answers were more common among those groups with lower educational attainment and at older ages. He additionally found limited evidence of anchoring, particularly for the HRS, given mostly consistent relationships between childhood health reports and self-rated health in adulthood at each study wave.

I completed a second methodological appendix (**Appendix B**), which is a reliability analysis analogous to the one reported by Haas (2007) where I examined discordant responses to three measures repeated in both the 2001 and 2003 waves – household sanitation facilities before age 10, and each parental education measure. Discordant responses may be indicative of recall bias, and I will examine demographic and health predictors of these discordant responses to alert me to subgroups for which these retrospective measures might be less reliable (e.g. older respondents). In addition, I estimated the relationship between these retrospective measures of childhood conditions and past-week depressive symptoms and two subjective indicators of health status, self-rated health, and relative health status compared to two years before (same, worse, or better) for each of the waves to assess how retrospective measures might be anchored by later-life health status and changes in health status over time.

3.3. Missing Data

Although the two-year time span between study waves of the MHAS is not sufficient for estimating change in chronic disease indicators like diabetes and hypertension, I did in some cases make use of both waves of MHAS. The reason for using both waves was to increase the number of available childhood socio-economic and health measures since distinct measures were asked in each wave. Although, as described in the results chapters that follow, the indicators of childhood hunger and paternal occupation were less useful in estimating migration history, or migration as a mediator or moderator of later-life health outcomes than I originally proposed. As a result, I generally completed my analyses using the baseline wave only.

However, for analyses in which using early life indicators that were added in 2003 contribute to my specific aims, I addressed respondent attrition across study waves by testing an inverse-probability weighting (IPW) method (Fitzmaurice, Laird, & Ware, 2011) (**Appendix C**). The IPW method involves estimating the probability of 2001 respondents completing the 2003 study using a logistic regression equation where the outcome is the odds of responding in 2003. Given that the MHAS includes some data on respondents who were not able to complete the 2003 wave due to death, illness, a move away, or another reason, through proxy respondents or next-of-kin, I used respondents' age, gender, residence, marital status, and 2001 health measures in order to estimate the probability of inclusion. I then used the inverse of the outcome – the inverse of the probability of inclusion in 2003 – as a probability weight for the regression models. This allowed me to assess whether or not the results from unweighted regression models differ from those weighted based on the probability of inclusion in the analytic, panel sample.

In addition to addressing missing due to sample attrition, I addressed missing values on individual variables. Income and wealth measures have been imputed by the MHAS study team given the somewhat high number of missing values for those measures. In other cases, as with the large number of 'don't know' indicators for parental education measures, I incorporate this missing category as a potential predictor of health outcomes, in the form of an independent response category. An ideal approach would be a full information maximum likelihood (FIML) approach (D. R. Johnson & Young, 2011). The FIML assumes that missing values are missing at random, or that the probability of missing values can be estimated based on available data. The FIML approach did not require working with multiple imputed datasets as with multiple imputation approach, and allows models to be run using an incomplete covariate matrix. However, the FIML approach should produce similar results as a multiple imputation approach given the same data, models, and a large enough number of 'imputed' datasets(D. R. Johnson & Young, 2011). I encountered some limitations to fully employing the FIML for some analyses. Specifically, when using logistic regression analyses, or when using factor variables, I was limited to completing the analyses using the GSEM framework in STATA 13, which does not allow for FIML, but something called 'equation-wise' deletion, which means that missing values are not completely replaced as with FIML, but information from cases missing on some values are used to help estimate the equation, which is an improvement on list-wise deletion (StataCorp LP, 2013). In the case of models with continuous outcomes and absent factor variables, I employed the FIML approach (i.e. the MLMV model specification within the SEM framework).

3.4 Analytic Plan

Addressing Emigration Selection Bias

One of the primary methodological dilemmas that I face in my dissertation analysis relates to emigration selection bias. That is, individuals who emigrate from Mexico to the U.S. are a non-random sample of the Mexican population. Those who have a history of migration to the U.S. may have different kinds of individual, family, and community characteristics compared to never migrants or internal migrants. These characteristics that relate to selection into emigration may also be associated with health outcomes, amounting to a problem with endogeneity. In regular regression models, the assumption is that by controlling for observable pre-migration characteristics (or confounders in the relationship between migration and outcomes), selection into migration will be independent of the anticipated outcomes. This idea, that migration status, D, is independent of outcomes (Y^1 or Y^0), conditional on or controlling for a set of confounders X, is called the "ignorability" assumption or selection on observables (Morgan & Winship, 2007). This assumption can be expressed with the following equation:

$$(Y^1, Y^0) \parallel D|X \qquad \textbf{Equation 1}$$

Violation of the ignorability assumption is what accounts for selection bias in studies of the effects of migration.

At least with regard to selection on observable characteristics, a propensity score matching approach might be well-suited to deal with some of the selection bias related to studying migration and health. The use of propensity score matching in causal inference responds to the following issues in observational studies: 1) we cannot randomly assign individuals to the so-called "treatment" of migration as in an experimental study. However, if we can "match" those cases with U.S. migration experience and cases without (e.g. return migrants versus non-migrants; family members of migrants and individuals with no migrant family members) on observable characteristics that might affect migration selection, then in theory it is possible to isolate the estimated effects of migration on health as related strictly to migration itself and not to other, observed characteristics that led to migration in the first place (Rubin, 1997). By condensing the characteristics that lead to selection into migration into a single composite characteristic – the propensity score – we are able to identify where respondents in an observational dataset 'overlap' or approximate one another in background or selection characteristics, we can focus on treatment effects, all else equal.

Put in terms of my study, I want to isolate the effects of migration on health, reducing the doubt that the relationship I find is explained by other, unobserved and unmeasured factors (e.g. personality traits, household circumstances, etc). It should be noted, however, that although in practice the assumption is that unobservable predictors of migration will be dealt with by matching respondents on a number of observable predictors of migration, the theoretical assumption of propensity score matching is that all predictors of the propensity for treatment (migration, family member migration) are observed (Morgan and Winship, 2007). This means that propensity score approaches do not deal entirely with unobserved heterogeneity in selection into U.S. migration. This shortcoming also points to the importance of including a comprehensive set of predictors in estimating of the composite propensity scores.

One underlying feature of propensity score methods is the idea that the ignorability assumption described in Equation 1 can be addressed by estimating a score that reflects the probability of U.S. migration experience given all of the relevant covariates, X. The probability of U.S. migration experience, D=1, given X, is the propensity score, expressed as $P(D=1|X)$. The revised version of the ignorability assumption given the propensity score is expressed here:

$$(Y^1, Y^0) \perp\!\!\!\perp D \mid P\,(D = 1|X) \qquad \textbf{Equation 2}$$

In practice, individual-level propensity scores (p_i) are estimated with a logit or a probit model predicting D = 1, or U.S. migration experience. The propensity scores can be used to obtain average “treatment” effects or the average effects of migration based on “matching” individuals with migration propensity scores that are similar to one another. Propensity scores can also be used to reweighting a standard regression model so that the distribution of X predictors looks the same for both migrant and non-migrant groups (akin to using a probability weight in regression models) (Nichols, 2007; Morgan and Winship, 2007).

Propensity score approaches have been used in several examples in the migration literature. For example, Xu and Xie (Xu & Xie, 2013) use a propensity score matching method in their analysis of the effects of parental and personal migration on a range of education, psycho-social and health variables for children in rural China. Lu and Treiman (2011) also make use of a propensity score approach in their analysis of the influence of parental migration and remittance behavior on children’s educational attainment in South Africa. While the authors prefer standard regression techniques for their final analysis, they use propensity score methods in sensitivity analysis to check whether or not findings from standard regression models hold. Finally, Wong and co-authors (2007) use propensity score matching methods to estimate the average effects of U.S. migration experience on current net household assets for male respondents to the MHAS. Again, the authors use propensity score matching methods to compare findings for the average treatment effects on wealth to regression coefficients where migration history is a predictor variable for logged assets. They found similar point estimates and similar patterns of significance when comparing wealth outcomes by migration experience in both regression and propensity score methods, and could therefore be confident that their regression results were robust to selectivity on balanced propensity scores of observed migration selection predictors.

I now turn to the analytic plans for each specific aim. The first and second aims employ the propensity score approach. All three aims also make use of a more traditional elaboration model in order to disentangle the mechanisms linking migration to health, and early childhood conditions to health, conditional on migration.

3.5 Specific Aim 1

Estimate the relationship between personal U.S. migration history and chronic health conditions (depressive symptoms, diabetes, hypertension) for older Mexican men.

The general approach for Specific Aim 1 and associated sub-aims follows Figure 3.1:

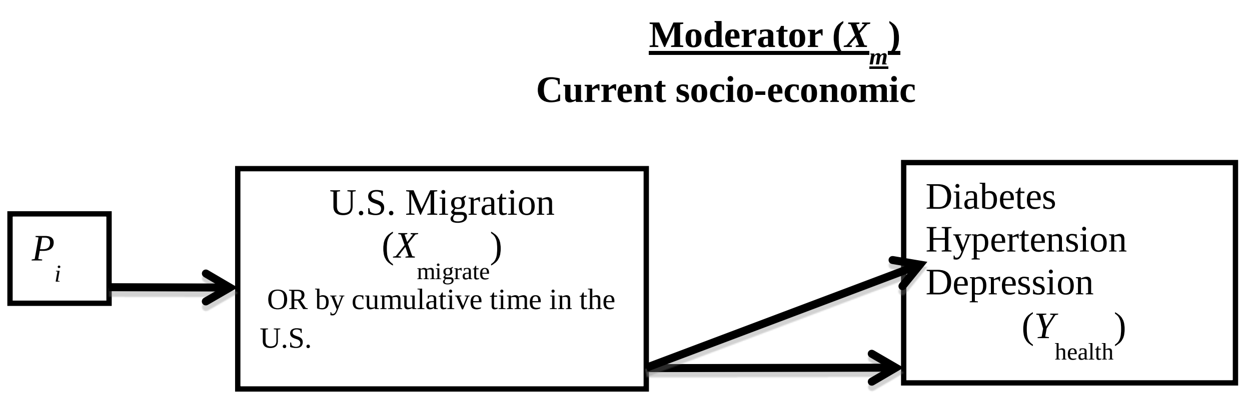

Figure 3.1. Analytic model for Specific Aim 1

First, I estimated a zero-order relationship between U.S. migration history and each of the three chronic health outcomes, paying attention to selection bias with propensity score approaches, and testing the effects of migration based on cumulative time in the U.S. and conditional on current socio-economic status indicators.

Propensity Score Approaches

To carry out the propensity score matching method, I first estimated the odds of migration (versus not migrating) based on a binary logistic regression of migration on relevant predictors. Based on the analyses of migration selection carried out by Wong and co-authors (2007), I tested the following variables in the logistic regression predicting migration propensity: respondent's age, year of first marriage, educational attainment, and childhood health and socio-economic status measures.[21] Based on this model of the log odds of migration, I generated propensity scores, p_i, that I used in both matching and weighting methods (Morgan & Winship, 2007; Nichols, 2007).

I used propensity scores to "match" respondents based on similar scores, and examined the average effects of migration on health (average treatment effects) based on similar propensity scores. The average treatment effects for this analysis can be interpreted as the difference in the probability of diabetes, hypertension, or depression for those who do and do not have a history of U.S. migration, given balance on the propensity to migrate, p_i. A T-value accompanying the

[21] There are of course other factors that contribute to the propensity to migrate, ranging from characteristics of family and community migrant networks to individual characteristics like risk tolerance and ability. While the MHAS does not include pre-migration indicators of individual risk or ability, it does include broad questions about parent's and sibling migration history. The problem with these measures is that it is unclear when these family members migrated, meaning that I cannot be sure if their earlier migration motivated the migration of the respondent, precluding my ability to use them as indicators of 'pre-migration' characteristics.

estimation of the average treatment effects serves as the test statistic for significant differences in the average treatment effects for U.S return migrants compared to never migrants.

As part of the matching analysis, I tested the commonly used algorithms for matching cases (nearest neighbor, kernel, Mahalabanois), and versions with and without replacement of treatment cases, all of which are easily compared with the available STATA commands, psmatch2 and pscore. In addition, I tested the area of common support – where the propensity scores for the migrant and non-migrant groups overlap – using a graph overlaying the density estimates of propensity scores for both groups. The estimates using the propensity score approaches are only be valid for those respondents who fall within this area of common support (Nichols, 2007).

Conditional Effects of Migration History on Health Outcomes

To address my sub-aims related to the conditional effects of U.S. migration experience on later-life chronic health conditions, I followed the basic model outlined in Figure 3.1. I estimated simple logistic regressions for diabetes, hypertension, and depression outcomes, respectively, and the main independent variable of U.S. migration history versus no-U.S. migration history[22]. For the continuous measure of past-week depressive symptoms, I compared results from both Ordinary Least Squares regression and negative binomial logistic regression for over-dispersed count data. Given similar findings in the direction and significance of associations, I prefer OLS

[22] For each logistic regression model suggesting a significant association between U.S. migration history and the odds of doctor-diagnosed diabetes, hypertension, or five or more past-week depressive symptoms, I will re-estimate log-binomial models to get risk ratios. For relatively common health outcomes (i.e. prevalent in 10% or more of the population), odds ratios may be inflated estimates of the risk of disease even if they adequately measure associations (Cummings, 2009). I will do these checks for analysis in Specific Aims 2 and 3 as well.

regression given its more clear interpretation, as well as relative ease with OLS regression understanding how additional variables mediate my zero-order relationship. Finally, using a linear model of depressive symptoms, I will try a lagged dependent variable model to assess the continued association between baseline characteristics and depressive symptoms two years later (D. Johnson, 2005).

After estimating the simple associations between the binary migration history and each of the health outcome measures, I tested the differential effects of migration on health by cumulative time abroad. For the analysis of the effects of migration on health given cumulative time abroad, I simply replaced the binary measure contrasting return U.S. migrants with those with no U.S. migration history with three category measures with the following contrasts: 1) return migrant, less than 5 years in the U.S.; 2) return migrants, 5 years or more in the U.S.; 2) no U.S. migration history (reference). I will examine any differences in the coefficients and significance level when comparing those with less versus more time in the U.S. to those with no time spent in the U.S.

I continued with the analyses of cumulative time abroad by estimating a logistic regression model with the migration by cumulative time abroad measure as the key predictor variable, controlling for demographic covariates that may serve as potential confounders of the association between U.S. migration experience and later-life health as well as migration selection factors, including early life health and family migration history measures, to see if there is any evidence that omitting these factors is suppressing an association between migration by cumulative time in the U.S. and later-life chronic disease and depression outcomes. Although my findings were mostly null, I added indicators of socio-economic status, and a categorical measure of body mass index in the case of models estimating hypertension and diabetes. In addition to specifying US migration experience by indicators of cumulative time abroad, I also re-ran simple and multivariable models of later-life health by number of trips to the US (non-migrant versus one trip versus more than one trip) and time since last return to the US (non-migrant versus 29 years or more versus less than 29 years).

For my third sub-aim, I tested the effects of U.S. migration history on each chronic health outcome, conditional on measures of current socio-economic status. I formally tested a multiplicative interaction term $(X_{migrate}*X_{SES})$ as a predictor in regression models where diabetes, hypertension, and depression are each the outcomes in turn. Given the concern that interaction terms that assess statistical (i.e. multiplicative) interactions may miss significant interactions between exposures that have biological meaning, I also tested for interaction effects using a STATA formula and calculator developed by Andersson and co-authors (2005). I tested interaction terms between several measures of socio-economic status, including household wealth, monthly income, household items, and self-rated economic conditions. I did not have the degrees of freedom to add interaction terms between the return migration indicator and each socio-economic status indicator into the same regression model and instead tested each interaction term in turn in a three-variable model, and then will only add significant interaction terms to a full regression model. Although I remain concerned about degrees of freedom, I was also interested in how conditional effects of U.S. migration experience (or no U.S. migration) based on current indicators of socio-economic status differed by rural and urban areas of Mexico, given evidence that greater wealth and income may translate in to poorer health risks for chronic disease outcomes in rural areas of Mexico and completed some stratified analyses of interaction effects by current residence characteristics. If there are no significant interaction terms between

U.S. migration experience and SES measures, I preferred a model with only main effects measures of each of these indicators.

I performed two additional analyses related to this aim. First, I re-ran models excluding respondents who report not having diabetes or hypertension, but also have not had a diabetes or hypertension test, respectively, in the past two years (see Appendix A). Alternately, I re-ran these models limiting them to respondents with better access to healthcare (i.e. has a usual source of care, has health insurance coverage) to see if there the effect of U.S. migration on diabetes or hypertension is conditional on access to medical care.

3.6 Specific Aim 2

Estimate the relationship between spouses' U.S. migration and hypertension, diabetes, and depression for older Mexican women.

To estimate the effects of spousal migration on later-life health for the MHAS sample of middle-aged and older Mexican adults, I carried out the same propensity score approach as outlined for the analysis of personal U.S. migration history for the male respondents. The variables used to estimate the propensity scores in this case were childhood socio-economic and health measures, including parental and respondents' education, respondent's age, and the number of years exposed to the Bracero period from 16 years old onward.

The remaining analyses plan for Specific Aim 2 will follow Figure 3.2:

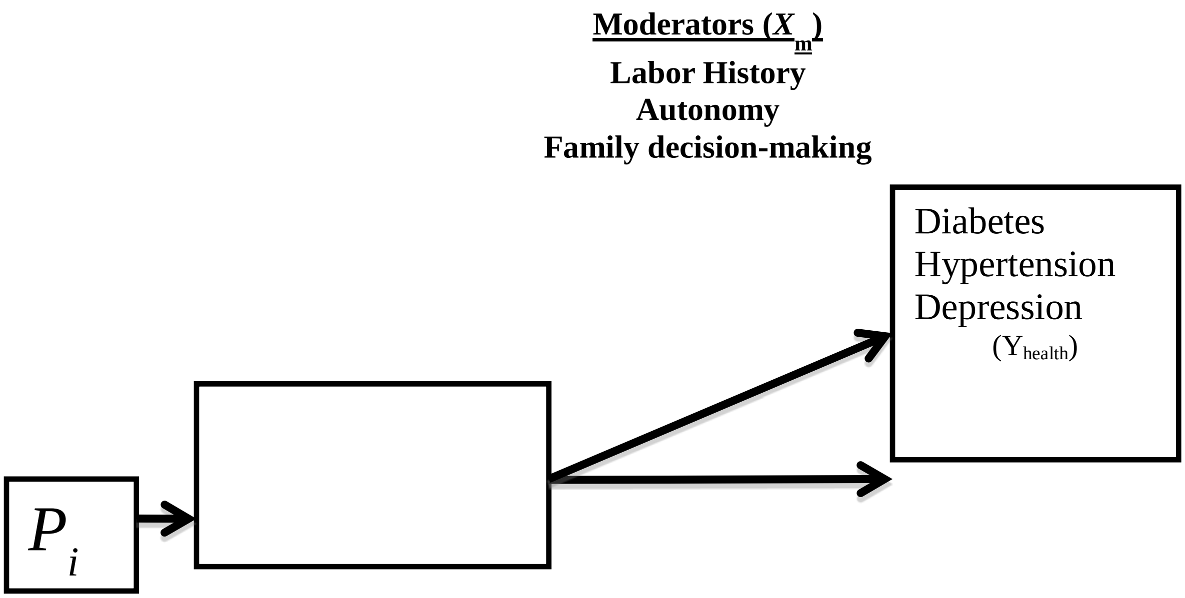

Figure 3.2. Analytic model for Specific Aim 2

For this analysis, I first estimated the zero-order relationship between the indicator of spousal migration history and each of the later-life health outcomes in turn with simple regression analyses. The methodological approach followed the regression models described for Specific Aim 1. For the outcomes of diabetes, hypertension, and five or more past-week depressive symptoms, I estimated logistic regression models where the outcome is the log-odds of diabetes, hypertension, or depression, respectively. I again tested models treating past-week depressive symptoms in a linear regression model that allows for full information maximum likelihood estimates.

Building on this zero-order relationship, I added a measure of whether or not respondents ever raised children alone, given my prediction that the adverse effects of spousal migration to the U.S. on later-life chronic health conditions would be mediated or explained in part by having to raise children alone.[23] I expected that the coefficient for the indicator of spousal migration history will be reduced, and spousal migration history may no longer have a significant association with health outcomes once adding in the measure of raising children alone. I built on the multivariable model by adding current socio-economic status measures. As with specific aim 1, I expected that by adding in these measures, the regression coefficient for the indicator of spousal migration history would decrease in size and significance (if it was still significant after adding the measure indicating a history of raising children alone).

I used this multivariable model as the foundation for testing interaction terms to assess the conditional effects of spousal migration history on later-life health outcomes by measures of labor and decision-making. I first tested interaction terms between the indicator of spousal migration history and key indicators of respondents' labor history, each in turn ($X_{s\_migrate}$*X_{labor}). These measures include those indicators of occupation type (including no work history), paid versus unpaid work, and years of work history. I tested this and other interaction terms between spousal migration to the U.S. and labor history indicators in regression models that control for other important predictors of women's labor market participation in Mexico, including age and education. I also tested for significant differences by urban and rural areas given fewer opportunities for women to join the labor force in rural areas and stronger norms discouraging women's work during spousal migration to the U.S. (Aysa & Massey, 2004).[24]

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[23] I am aware of the challenges in estimating mediating effects in logistic regression analyses, given the difficulty in comparing coefficients across logistic regression models. One way of addressing this is through an approach developed by Kohler and authors (2011) that decomposes direct and indirect, or mediated associations in logistic regression models.

[24] I will test for cohort effects in this spousal migration-labor interaction, given changes over time in labor participation and sectors for women in Mexico (Parrado & Zenteno, 2001). I do not have the degrees of freedom to distinguish multiple cohorts of female respondents, but may

Finally, I tested my sub-aim related to the conditional effects of spousal migration on later-life chronic health conditions, given indicators of mastery or sense of personal control in general and decision-making power within marital relationships. I tested interaction terms between spousal migration history to the U.S. and 1) a continuous measure of perceived personal control and 2) a binary measure of whether or not respondents have less say (compared to more or equal say) in making family decisions relative to their spouses. In the complete multivariable model, I additionally controlled for measures of respondent's age, education, occupational history (e.g. any work history), current marital status, and length of marital history, since these factors may all contribute to perceived personal control or internal locus of control overall, as well as decision-making power within relationships (Krause, 1999; Parrado et al., 2005).

3.7 Specific Aim 3

Test U.S. migration experience (personal and family) as a moderator of the relationship between early-life conditions and later-life hypertension, diabetes, and depression for older Mexican adults.

For my third specific aim, I estimate a model following Figure 3.3:

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assess differences for women 60 and older versus those younger than 60, since these are fairly balanced groups.

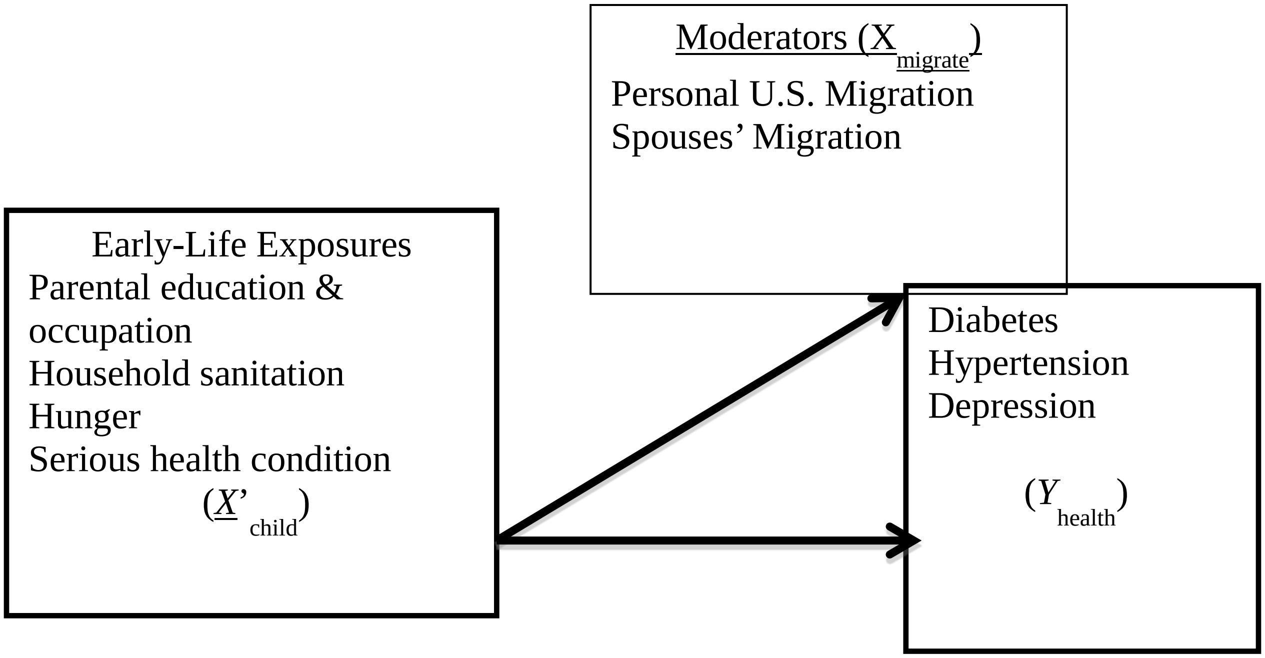

Figure 3.3. Analytic model for Specific Aim 3

Given this model, I first examined the zero-order association between the indicators of early-life socio-economic and health conditions and each of the later-life chronic health conditions using simple and multivariable regression models. I next included an interaction term in regression models with measures of personal U.S. migration history for male respondents and spousal U.S. migration history for female respondents (i.e. $X_{earlylife} * X_{migration}$). Given that I had limited degrees of freedom to test interaction terms for all early-life measures, tested each interaction term on its own in separate, multivariable models controlling for additional demographic and residence measures and current socio-economic status indicators.

When coefficients for the interaction terms between indicators of early-life conditions and migration history were significant, I took that to be evidence supporting the moderation effect of migration on the latent, long-term effects of early-life socio-economic status. If the interaction coefficients were not significant, I took that to be evidence that the relationship between early-life conditions and later-life chronic health outcomes, to the extent that there is a relationship, persists the same way for individuals with personal or family U.S. migration experience.

Chapter 4: U.S. Migration and Health for Older Mexican Men

4.1 Introduction

The purpose of this chapter is to estimate the relationship between personal U.S. migration history and chronic health conditions (depressive symptoms, diabetes, hypertension) for older Mexican men. In particular, I will describe characteristics of older Mexican men by whether or not they report a history of migration to the U.S. and will then estimate the average effects of U.S. migration on the later-life health outcomes of Mexican men accounting for characteristics that may have influenced selection into US migration, including childhood health and socio-economic status. I will also estimate health outcomes for migrants who spent more or less cumulative time abroad or made more than one trip to the U.S., and other dimensions of migration timing. Given my theoretical interest with how U.S. migration intersects with other social determinants of health, I will estimate differences in the effect of U.S. migration for return migrants and non-migrants based on current socio-economic conditions and place of residence. I have added ancillary analyses of how personal U.S. migration intersects with the U.S. migration of other family members to influence later-life health for older men.

I hypothesize that older Mexican men with U.S. migration history will have *higher* probabilities of diabetes and hypertension and higher mean depressive symptoms compared to their non return-migrant counterparts (higher average treatment effects) given similar propensities to migration, or similar factors relevant for migration selection. Second, given the potentially adverse effects of long-term exposure to the U.S., I hypothesize that longer stays in the U.S. will be associated with poorer later-life chronic disease and mental health outcomes, all else equal. I have additionally estimated models of U.S. migration and later-life health by specifying the number of trips to the U.S. and time since the last return to Mexico. I expect that more trips to the U.S. will be associated with poorer later-life health, as will more recent U.S. migration experiences (i.e. less time since last return to Mexico).

Finally, due to the fact that return migrant health outcomes are often closely linked to their current socio-economic status, given potential for shifts in absolute and relative socio-economic status for those with return U.S. migration experience, I also hypothesize that the health outcomes for older Mexican return migrant men compared to non-migrant counterparts will be conditional on current indicators of socio-economic status. I expect that overall those return migrants with higher socio-economic status will have lower probabilities of diabetes, hypertension, and fewer past-week depressive symptoms compared to their non-migrant counterparts with lower socio-economic status. However, given the uneven epidemiological transition in rural and urban areas, I expect that the conditional effect of migration on health outcomes given socio-economic status indicators may additionally depend on respondents current region of residence; improved socio-economic status might be a health risk factor in rural areas of Mexico.

4.2 Descriptive Statistics

Table 4.1 presents descriptive statistics for key demographic and socio-economic characteristics of this sample of middle-aged and older Mexican men. It shows differences by whether or not respondents report a history of migration to the U.S. For those with some history of U.S. migration, it reports differences by measures of cumulative time abroad (more than five years abroad), as well as number of trips (more than one trip) and time since return (>29 years since last return).[25]

Overall, respondents with U.S. migration history tend to be slightly older than their counterparts with no U.S. migration experience (64 years old versus 62 years on average). Return U.S. migrants are less likely to live in urban areas of Mexico at the time of the baseline interviews, but are significantly more likely to live in one of the six historically high out-migration states that were oversampled as part of the MHAS study design: nearly half of those with U.S. migration history live in these historically high out-migration states compared to a quarter of those with no reports of migration to the U.S. Those who reported migrating more than once to the U.S., perhaps as part of a pattern of circular migration, are even more likely to live in these high out-migration states, and less likely to live in urban areas of Mexico than the overall group of U.S. migrants. Current marital status is similar across all groups, with the majority of respondents indicating that they are currently married or in a consensual union.

Return U.S. migrants report conditions of childhood health and socio-economic status that suggest significantly greater disadvantage in early life compared to their counterparts with no U.S. migration experience. A significantly greater proportion of US return migrants reported having no household sanitation facilities (77% compared with 68% of those with no US

[25] These cut-off points are based on mean values: the average number of cumulative years abroad was 4.5 years for return U.S. migrant men, and the average number of years since the last return was 29.8 years before the study. Over 40% made more than one trip to the U.S. Another notable aspect of U.S. migration experience is that it was initiated mostly during the Bracero Era: 53% of first trips were between 1942 and 1964. A third of return U.S. migrant men made their first trip in the decades following the Bracero period, and leading up to the Immigration Reform and Control Act (IRCA) of 1986. Only 10% made their first trip after IRCA. The median year of first return to Mexico was 1963, as the Bracero period was coming to an end; the median year of most recent return was 1970, reflecting the fact that many migrants made multiple trips to the U.S.

migration experience, $p<0.001$) and having a serious illness or injury (14% compared with 10% of non-return US migrants, $p<0.001$) before age 10. In addition, a quarter of return U.S. migrants reported having no formal education compared with about 21% of those with no U.S. migration experience ($p<0.01$). About a third of the sample reported frequently going to bed hungry before age 10, with no significant differences between return U.S. migrants and those who reported no migration to the U.S.

Despite the significant differences in early life socio-economic status between return U.S. migrant men and their counterparts with no U.S. migration experience, there appear to be fewer differences in *adult* socio-economic status between the two groups. There are some differences in work history, with 40% of US return migrants (and almost 50% of those who made more than one trip to the U.S.) reporting agriculture as the primary sector they worked in over their lifetime, as compared to 27% of those with no US migration experience. Those who never migrated to the U.S. had higher rates of professional, factory, and domestic work. Despite these differences in occupational histories, there are no significant differences in current socio-economic status as measured by the average number of household items (e.g. refrigerator, telephone), self-reported economic conditions, or the percentage of respondents in the bottom half of monthly income or net assets as assessed for the entire MHAS sample.

Return U.S. migrants are more likely to report U.S. migration within their family networks compared to their counterparts with no U.S. migration experience. Nearly 60% of return U.S. migrants reported that either their parents or their siblings ever migrated to the U.S. to work or live compared to about a quarter of those with no U.S. migration experience. There are also significant differences in the percentage of respondents who have at least one child living in the U.S. based on respondents own migration to the U.S. Whereas 43% of respondents with some U.S. migration history also have at least one adult child who was living in the U.S .at the time of the survey, only about 18% of those with no U.S. migration history have an adult child living in the U.S. The more detailed indicators of U.S. migration experience suggest that those respondents who made more than one trip to the US and who spent more cumulative time in the U.S. reported higher rates of having adult children in the U.S. compared to U.S. migrants on average – more than half of respondents who made more than one trip and who spent more than five years in the U.S., respectively, reported having an adult child in the US at the time of the survey.

Table 4.2 presents descriptive statistics for differences in health and health care indicators for middle aged and older Mexican men by U.S. return migration history. As indicated by the chi-squared statistics, there are almost no significant differences across indicators of the health outcomes: doctor-diagnosed diabetes and hypertension, and past-week depression. There are also no significant differences in respondents' reports of recent testing for hypertension or diabetes, which might be indicative of differential access to health care or to quality health care by migrant group. There were also no significant differences in respondents' body mass index, which is a key risk factor for diabetes and hypertension. There were significant differences in respondents' smoking status, with U.S. migration experience more likely to have ever smoked in their lifetime; a third of non-migrants report never smoking in their lifetime compared to a quarter of those with some U.S. migration experience. However, the primary differences between the two groups appear to lie in the category of 'former smoker'; similar rates of return U.S migrants and non-U.S. migrants report currently smoking. There are also no significant differences in the rates of current drinking status for return U.S. migrants and non-U.S. migrants.

Return U.S. migrants were significantly less likely to report having insurance coverage compared to those who never went to the U.S. to live or work (56% of return migrants reported some insurance coverage compared to 62% of non-U.S. migrants, $p<0.001$). Despite the differences in insurance status, respondents report very similar rates of having a usual source of medical care; insurance coverage may not be a major impediment to health care access for this sample of middle-aged and older Mexican men.

4.3 Simple Models

Table 4.3 presents simple models predicting the association between U.S. migration experience and later-life health outcomes for older Mexican men. Among return U.S. migrants I test associations between three more specific indicators related to migration experience – number of trips, time since last migration, and cumulative years abroad. The only significant results across all tests were related to depression. Specifically, respondents who reported ever living or working in the U.S. were associated with 25% greater odds of reporting past-week depression with no additional controls ($p<0.05$). Those who reported more recent migration were significantly less likely to report depression (OR: 0.56, $p<0.01$) compared to those who completed their migration more than 29 years ago; again there are no controls included here and those who report more recent migration are also likely younger, which might be driving the lower estimated odds of depression. Finally, counter to my hypothesis, those who less time in the U.S. (five or fewer years in the U.S.) are associated with significantly greater odds of depression compared to non-U.S. migrants, while there are no significant differences in depression between those who spent more cumulative time (more than five years) and the non-U.S. migrant reference group. Specifically, those with less time in the U.S. were associated with 52% greater odds of depression compared to those return U.S. migrant men with more time in the US, accounting for no other controls (p<0.05).

I finally test associations between an indicator of both respondents' personal migration and other family member migration to the U.S. (i.e. parent and sibling). I find that respondents who migrated but did not report either parental or sibling migration to the U.S. had significantly greater odds of past-week depression compared with the reference group of respondents who reported no personal or family member migration (OR: 1.35, p<0.01). In contrast, respondents who reported family member migration to the U.S. but who themselves did not migrant reported significantly greater odds of doctor-diagnosed hypertension than their counterparts with neither personal nor family member U.S. migration experience. [26]

Table 4.4 presents the results of analyses using different specifications of U.S. migration experience to predict depressive symptoms as a continuous measure at baseline.[27] The results

[26] I also test a four-category measure of parent and child migration analogous to the measure I created for different configurations of respondent and family member migration (i.e. neither respondent nor child migrated, both migrated, child only migrated, parent only migrated). The only significant finding was that those who reported no personal U.S. migration experience but had an adult child living in the U.S. had significantly greater odds of past-week depression compared to the reference category of respondents who reported no US migration for themselves or any of their adult children (OR: 1.28, 95% CI: 1.09, 1.50, p<0.001), although this significant association goes away after controlling for the demographic and socio-economic covariates. I additionally test whether or not child migration to the U.S., on its own might be significantly associated with doctor-diagnosed hypertension or diabetes. Having at least one adult child in the U.S. is significantly associated with greater odds of past-week depression without controls (OR: 1.17, 95% CI: 1.03, 1.35, p<0.05), although the association was no longer significant when I controlled for measures of respondents residence, including living in a more or less urban area, and living in a high out-migration state or not. I therefore decided not to carry out models of any of the health outcomes using having an adult child in the U.S. as a covariate; it would neither confound nor mediate an association between respondent migration and later-life health outcomes because it is not a significant predictor of these health outcomes on its own.

[27] There were no significant associations between any of the U.S. migration variables and depressive symptoms in 2003 using a lagged dependent variable approach (not shown).

predicting baseline depressive symptoms in particular reflect the findings from the logistic regression analysis using the five-point cut-off to approximate depression: U.S. migration experience is associated with significantly more depressive symptoms, as is U.S. migration experience that happened in the more distant past, and that lasted less cumulative time. Reporting no U.S. migration experience while one's family members did migrate to the U.S. to live or work, and having an adult child currently living or working in the U.S. are each significantly associated with significantly more depressive symptoms. The magnitude of the effects of each of these indicators of U.S. migration on depressive symptoms is small, with each accounting for less than half a point difference on a 9-item scale, or less than 6%, without controlling for other measures. By way of contrast, self-reporting a poor financial situation at the time of the survey was associated with more than a one-point increase in depressive symptoms, or 11% difference in an analyses without controls ($p<0.001$, not shown).

4.4 Multivariable Logistic Regression Models

Although the results for hypertension and diabetes were not significant without controls, for completeness I carried out multivariable models for all health outcomes, using both binary indicators of migration history (U.S. return migrant versus no personal U.S. migration experience), and with alternative specifications of migration history that take into account 1) cumulative time abroad, 2) time since last return to Mexico, and 3) number of trips to the U.S. (one trip versus more than one trip). As would be expected, I find no significant associations between U.S. migration experience and diabetes or hypertension using any of the specifications of migration to the U.S. (not shown).

I review the multivariable results for depression in greater detail, given that they were significant in simple analyses and remain significant in some of the multivariable models. In

Table 4.5, I model depression outcomes on the three-variable measure of U.S. migration experience, specifying time since migration. The results for the first model suggest that even when controlling for age, residence characteristics, and marital status, a more distant history of U.S. migration appears to be associated with higher odds of past-week depression compared to those with no U.S. migration. However, when I add indicators of childhood socio-economic status and health in the second model, the significance of the migration indicator goes away. This makes sense, given that the descriptive statistics show that return U.S. migrants are more likely to have experienced socio-economic and health disadvantages in childhood, with lower levels of education and more frequent reports of having no sanitation facilities and suffering from a serious health condition before age 10. Each of these conditions is in turn associated with greater later-life depression. This suggests that the effect of past migration on later-life depression is not necessarily due to the experience of migration itself (and migration in the distant past in particular), but due in part to the greater incidence of childhood disadvantage among this group of return U.S. migrants relative to their non-migrant or more recent migrant counterparts. There is no significant difference in the odds of depression for those with more recent migration, whose returns to Mexico took place 29 or fewer years before the study, compared to those with no U.S. migration history.

Tables 4.6 through 4.8 I present more condensed results for models of depression using the alternative specifications of U.S. migration experience. None of these specifications are robust to the demographic controls in the first multivariable models, and continue to be non-significant predictors of past-week depression when adding the indicators of childhood SES and health, as well as current socio-economic status indicators.

The final multivariable logistic regression model uses the four-category indicator of respondent and family member migration to the U.S. as a predictor of hypertension (Table 4.9). I find that respondents who report that at least one of their family members migrated to the US to live or work but who did not themselves have U.S. migration experience had 25% greater odds of reporting a hypertension diagnosis compared with their non U.S. migrant counterparts who did not report that any of their family members migrated to the U.S. even when controlling for the full set of demographic characteristics, and child and adult socio-economic indicators ($p<0.01$). This finding speaks less to the effect of U.S. migration itself, since there does not seem to be a significant association between respondents' U.S. migration and later-life health outcomes, but more to the effect of U.S. migration on the health of those who are so-called 'left behinds', who never migrate to the U.S. but nonetheless experience its impacts. These results were only apparent in the case of hypertension, however; there was no significant association between family and personal US migration configurations and later-life depression or diabetes in the multivariable models (not shown).

In Table 4.10 I repeat the multivariable analyses across all specifications of U.S. migration experience using the continuous measures of depressive symptoms at baseline. After controlling for the full set of covariates, there is no significant association between U.S. migration experience and later-life depressive symptoms for this sample of older Mexican men, regardless of how U.S. migration experience is specified. There continued to be a significant association between having an adult child living or working in the U.S. and slightly increased depressive symptoms (B: 0.16, $p<0.05$), but no significant association between the migration of other family members to the U.S. and later-life depressive symptoms.

4.5 A Propensity Score Matching Approach

While there have not been any significant findings in the main effects of U.S .migration history on later-life health for middle-aged and older Mexican men, I still run through the steps of addressing migration selectivity using a propensity score matching approach. Table 4.11 presents a multivariable model with indicators that predict whether or not respondents are return U.S. migrants or not. These indicators are limited to pre-migration conditions, including age, education, childhood health and socio-economic status, and exposure to the Bracero era. The indicator of exposure to the Bracero era is a constructed variable that measures exposure starting at 16 years of age to the era between 1942 and ending in 1964 that saw a large flow of Mexican labor migration into the U.S.. Each additional year of exposure to this historical period is associated with 2% greater odds of reporting U.S. migration experience, controlling for childhood health and sanitation facilities ($p<0.001$). Lacking sanitation facilities is associated with significantly greater odds of US migration during one's lifetime for this group of older Mexican men ($p<0.001$), and so is having an episode of serious illness during childhood.

Other predictors that were not significant in the model include respondents' age, educational attainment, and their mother's educational attainment, which serves as another indicator of early-life socio-economic status. Note that the variables used to estimate propensity scores in the matching approach do not necessarily need to be significant predictors of migration, but should include as many "baseline" covariates as are available (Austin, 2011). In this case, I take "baseline" to mean characteristics of respondents that took place before their first migration to the U.S.

The results from the propensity score matching approach reflect what I found in the multivariable analyses (Table 4.12).[28] That is, there does not appear to be an association between migration to the U.S. and depression, diabetes, or hypertension for older Mexican men living in Mexico, as indicated by the non-significant average treatment effects. In fact, the direction of the average effects of return migration to the U.S. is opposite of I originally hypothesized: after matching respondents on childhood SES, health, and migration context, the proportion of respondents estimated to have doctor-diagnosed hypertension or diabetes is actually *lower* were they to be return U.S. migrants compared to non-U.S. migrants, although the difference is not significant.

4.6 Multiplicative Interaction Effects

After testing the main effects of U.S. migration experience on health outcomes for older Mexican men, both with regression and propensity score matching approaches, I turn to assessing interaction effects. In particular, I test whether or not the effects of U.S. migration experience on health might vary based on respondents' current socio-economic status. If U.S. migration experience earlier in life continues to influence chronic health conditions later in life, the pathway might be through the potential for improved socio-economic status that some U.S. return migrants experienced. Better economic conditions may have improved health chances by

[28] I use the –teffects— function in STATA 13, which uses a nearest neighbor matching approach with replacement. This approach should produce similar results compared to some of the alternative methods (e.g. kernel, interval) offered in earlier versions STATA, but with more accurate estimation. That is, the – teffects – command accounts for greater uncertainty in its estimates of standard errors, which results in more accurate estimates of significance. I also run a post-estimation test of overlap of the propensity for migration to the US with the idea that respondents who might not plausibly match to any other respondent based on the group of "selection" covariates (e.g. early childhood circumstances, exposure to Bracero era), be 'trimmed' from the analysis. However, I find that respondents with and without migration to the US overlap sufficiently so that I do not have to trim respondents from my analysis.

enabling access to better quality health care, but also may have increased return migrants participation in health risk behaviors –principally the consumption of processed, high-calorie foods, tobacco and alcohol.

I found no significant statistical interaction between U.S. migration experience and socio-economic status indicators, including indicators of monthly income, total net assets, and subjective evaluation of financial status, in their effect on hypertension, diabetes, or depression[29]. That is, I estimate a non-significant association between U.S. migration experience and later-life chronic disease for older Mexican men at different socio-economic strata. Referring again to the descriptive indicators of health behavior and healthcare access, it appears that older Mexican men have similar distributions of risky health behaviors and access to care, and that this distribution appears to be similar for U.S. migrants and non-U.S. migrants across all socio-economic strata.

I next move on to test interaction terms between respondents U.S. migration history and current resident characteristics (i.e. more or less urban, high U.S. out-migration state or not). It may be that U.S. migration experience affects health differently based on current characteristics of respondents' broader geographic, socio-economic, and health contexts. For example, qualitative research suggests that in rural areas return U.S. migrants who maintain social ties to the U.S. may have better access to health care options both in the U.S. and Mexico compared to their non-migrant counterparts who struggle with underserved rural Mexican healthcare systems (Salinas, 2008). Such disparities may not occur in more urban areas of Mexico, where there is

[29] Please see Table 4.21 for a summary of significant and non-significant results across all tests in this chapter.

better access to health care overall and U.S. social networks may be less critical in terms of filling the gaps in care.

I find no significant interaction effects between U.S. migration experience and residence characteristics for any of the three health outcomes. I also test interaction terms by my three alternative specifications of U.S. migration experience – by number of trips, cumulative time abroad, and years since final return migration – and the SES and residence measures for each of the three health outcomes. There were no significant results for these tests. That means that even when considering different kinds of U.S. experiences, there is no significant difference in health outcomes for U.S. migrants compared with non-U.S. migrants by different measures of current socio-economic status and residence characteristics.[30]

4.7 Additive Interaction Effects

While none of the multiplicative interaction effects between U.S. migration experience and later-life socio-economic status and residence were significant, I move on to an alternative method of testing interaction effects using an additive method described by Andersson and co-authors (2005). In contrast to the findings for multiplicative interaction effects, I find many significant interactions between U.S. migration and indicators of current SES and residence characteristics in their effect on the later-life health of Mexican men.

In Table 4.13 I present results of the additive interaction terms for later-life depression. The results of the interaction analyses with indicators of current socio-economic status indicators suggest that return U.S. migrants who have more favorable economic conditions are not

[30] There were no significant interaction terms between U.S. migration experience and any of the potential moderating variables for models using the continuous depressive symptom measure (not shown).

significantly different in terms of their later-life depression compared with non-U.S. migrants who also have relatively favorable economic conditions, which is the reference category in all cases. On the other hand, return U.S. migrants with poor economic status do have a higher risk of later-life depression compared to non-U.S. migrants with more favorable economic status. Specifically, the risk of later-life depression is two times greater for return U.S. migrants with poor self-rated economic conditions at the time of the survey compared with non-U.S. migrants who rate themselves as having sufficient income to meet their basic needs (RR: 2.03, 95% CI: 1.58, 2.60, $p<0.001$). Table 4.16 presents a four-by-four table for a clearer depiction of these findings. Similarly, return U.S. migrants who report incomes that are in the bottom half of the overall income distribution and bottom half of the wealth distribution for the MHAS sample, respectively, have greater estimated risk of later-life depression (RR with income: 1.35, 95% CI: 1.07, 1.70, $p<0.01$ Table 4.17; RR with wealth: 1.37, 95% CI: 1.08, 1.74, $p<0.01$).

This finding supports my hypothesis that the effects of U.S. migration experience on later-life health would depend on whether or not respondents continued to reap the potential economic benefits of working in the U.S. None of the additive interaction effects with current socio-economic status were significant for the diabetes outcome, however, and only the interaction term with self-rated economic situation was significant for the hypertension outcome (Table 4.14). The finding is similar to the one I observed with depression, whereby return U.S. migrants with poor self-rated economic situation have significantly greater risk of hypertension later in life compared to non U.S. migrants with better self-rated economic conditions (RR: 1.23, 95% CI: 1.04, 1.45, $p<0.05$). In contrast, there is no significant difference in hypertension for return U.S. migrants with relatively good self-rated economic conditions compared to their non-

U.S. migrant counterparts with good self-rated economic conditions. See Table 4.18 for a four-by-four table depicting these results.

I also test additive interaction terms between U.S. migration experience and residence characteristics in their effects on each of the three health outcomes, with significant results for diabetes and depression only. In the case of depression, it appears that living in a high out-migration state is associated with higher risk of depression for both return U.S. migrants and non-U.S. migrants. Non U.S. migrants living in states with high out migration to the U.S. have a greater risk of depression compared to non U.S. migrants living in other Mexican states (RR: 1.29, 95% CI: 1.10, 1.51, $p<0.01$); U.S. migrants living in states with high out migration also have a higher risk of depression compared to the reference group of non US migrants in other Mexican states (RR: 1.47, 95% CI: 1.17, 1.84).

In contrast, there appears to be a protective effect of being both a U.S. migrant and living in a high out-migration state in the case of doctor-diagnosed diabetes (Table 4.15); those who are return U.S. and live in a high out-migration state have a lower risk of diabetes than their counterparts with no U.S. migration history who live in other Mexican states (RR: 0.71, 95% CI: 0.51, 0.99, $p<0.05$). This protective effect is not apparent for non-US migrants in high out-migration states or for return U.S. migrants in other states. Finally, there is a significant additive interaction effect between U.S. migration experience and whether or not respondents live in more or less urban areas for the diabetes outcome only. Specifically, those who are both return migrants and live in less urban areas have a lower estimated risk of diabetes compared to non-U.S. migrants living in less urban areas. See Tables 4.19 and 4.20, which depict these results in four-by-four tables.

The final interaction terms I test using the additive interaction methodology are between personal migration to the U.S. and the migration of other family members, in this case parents and siblings. There are significant interaction effects between U.S. migration experience and the migration of either parents or siblings to the U.S. for both depression and hypertension. The results largely reflect what I described in the multivariable regression results using a four-category measure of family member and personal U.S. migration status. That is, the risk of depression and hypertension is greater for those who are not U.S. migrants themselves but who have U.S. migrant parents or siblings compared to those who report neither personal or family migration to the U.S. (RR for depression: 1.23, 95% CI: 1.04, 1.45, $p<0.05$; RR for hypertension: 1.20, 95% CI: 1.03, 1.40, $p<0.05$). There is no significant difference on the other hand in the risk of depression or hypertension for return U.S. migrants with no migrant family members or for those who report both personal and family member migration compared to reference group of no personal or family U.S. migration. This again supports the idea of being 'left behind' as a potential health risk factor, at least in the case of this sample of middle-aged and older Mexican migrant men. I also tested interaction terms between U.S. migration experience and whether or not respondents currently have an adult child in the U.S., but found no significant results for any of the health outcomes (not shown).

4.8 Discussion

The results of this chapter suggest largely non-significant associations between U.S. migration experience and later-life health for older Mexican men, at least in terms of main effects. Table 4.21 summarizes these results across all tested models. While I found evidence of some significant simple associations between US migration experience and depression, these results were no longer significant when accounting for childhood socio-economic status and health indicators. That is, it does not appear to be the experience of U.S. migration that explains the association with later-life depression, but rather the fact that U.S. return migrants report more disadvantaged childhood conditions, which are in turn associated with greater depression. The results for hypertension and diabetes were not significant even in tests of associations without controls, and when using different specifications of U.S. migration experience by number of trips, time since return, and cumulative years abroad.

The lack of significant main effects in the analyses of U.S. migration experience and later-life health for older Mexican men are corroborated to some degree by other studies of the health of return U.S. migrants. In their analyses of data from the Mexican Migration Project, Ullmann, Goldman and Massey (2011) report that there is no significant association between U.S. migration experience and diabetes, hypertension, or a global measure of self-rated health. Riosmena and authors (Riosmena et al., 2013) find no significant differences in doctor-diagnosed diabetes for a group of older Mexican migrants with less than 15 years of experience in the U.S. compared to non-migrants in Mexico, although the group of U.S. migrants included Mexican-born men in the U.S. *and* return U.S. migrants in Mexico who responded to the MHAS. This combined group of Mexican migrants to the U.S. with less than 15 years in the U.S., living both in the U.S. and Mexico in middle-age and older adulthood, had significant *lower* odds of doctor-diagnosed compared to non-U.S. migrants in Mexico.[31]

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[31] Riosmena and authors provide little justification for the cut-off of 15 years, although they indicate that because their study also includes a US sample of Mexican immigrants who have been in the US for very long periods of time, the average number of years in the US is likely much higher in this combined US and Mexico sample compared to the MHAS sample alone. Nevertheless, I test my analyses using an indicator of US migration with markers of cumulative time using a 15-year cut-off and find no change in my results.

On the other hand, studies of return U.S. have reported significant differences in some health outcomes and risk behaviors when comparing returnees to those with no U.S. migration experience. Ullmann and authors did find that return U.S. migrants had significantly greater odds of "emotional or psychiatric disorders", and heart attack or other heart problems using the Mexican Migration Project data (Ullmann et al., 2011). Familiar and co-authors found that return U.S. migrants had significantly greater odds of depression compared to a reference group of respondents with neither personal nor family U.S. migration, using a survey of adults across five Mexican cities (Familiar et al., 2011). Some of the discrepancy between my findings of no significant association between U.S. migration experience and later-life depression in multivariable models using the MHAS and the significant results in these studies may be due to measurement and sample differences. For one, the measure of "emotional or psychiatric disorders" used by Ullmann and authors is vague, and appears to have been asked as a single, binary measure rather than using a scale of symptoms. Familiar and authors did not stratify by gender or include older adult respondents, as I do here. Finally, both the MMP sample and the sample reported by Familiar and co-authors include younger migrants who have migrated to the U.S. more recently and may have been exposed to even more acute anti-immigrant discrimination and stressors related to undocumented status in the US compared to older US migrant cohorts; more recent return US migrants may have worse mental health status as a consequence of these worsening circumstances for Mexican immigrants in the US, and those without documents in particular.

Ullmann and authors also found that return US migrants were more likely to be obese and smoke than their non-U.S. migrant counterparts in the Mexican Migration Project sample. In contrast, I did not find as much evidence of differences in health behaviors for the MHAS sample, which might help explain the finding of no significant differences in later-life hypertension and diabetes. Specifically, return U.S. migrants and non-U.S. migrants were similar in terms of body mass index; differences in respondent smoking status by U.S. migration experience seem to be largely driven by differences in the category of ‘former smokers’ rather than in reports of current smoking. The fact that there are so few significant differences in some of these health behaviors is surprising, given the understanding that greater financial resources generated from working in the U.S. often translate into more opportunities for consuming tobacco, alcohol, and processed, high-calorie food, which may be reflected in the findings from the Mexican Migration Project (MMP) data. On the other hand, in contrast to the MMP sample, the MHAS is nationally representative, including both urban and rural samples, and is limited to individuals 50 years and older who migrated in the distant past, on average. Riosmena and authors (2013) also did not find significant associations between US migration and smoking or obesity for older Mexican men compared to non-U.S. migrants, although as noted above their “U.S. migrant” category was a combination of return U.S. migrants in Mexico from the MHAS sample and older Mexican men living in the U.S.

Interactions between U.S. migration and current SES or residence have not previously been reported in the analyses of U.S. migration and later-life health for the MHAS sample (Aguila et al., 2013; Riosmena et al., 2013). Nevertheless, I found no significant interaction effects between U.S. migration and current SES or residence characteristics for any of the health outcomes using multiplicative interaction. However, I found significant results for interaction effects between U.S. migration and current SES and residence using an additive interaction methodology. As an alternative to the multiplicative method, which detects statistical interactions (i.e. effects that are either larger or smaller than the product of the two exposures of interest, such as being a US return migrant and living in a more urban area), the additive interaction methodology detects interactions that are larger or smaller than the sum of two exposure variables, which may more accurately reflects the biological processes by which two exposures might contribute jointly to health outcomes (Rothman, Greenland, & Walker, 1980).

Using these additive interaction terms, I found that return U.S. migrants who were relatively worse off economically at the time of the survey were at greater risk for depression and hypertension compared non-U.S. migrants who had good self-reported financial status. On the other hand, return U.S. migrants who had good self-reported financial status had similar risk for later-life depression and hypertension as their non-U.S. migrant counterparts. This means that the effect of U.S. migration experience on some later-life health outcomes may depend on whether or not return U.S. migrants were able to make economic gains (and sustain these gains until middle-age or older adulthood). As long as return U.S. migrants achieve a subjective sense of financial well-being by later life, U.S. migration does not necessarily pose a risk for depression and hypertension. Those return U.S. migrants who do not report this sense of financial well-being had increased risk of later-life depression and hypertension, and similar patterns were observed for additive interactions of return U.S. migration and wealth and income, respectively, in the model of depression. These findings may reflect the potential for economic stratification among U.S. migrants once returned to their communities of origin based on the number of trips they made to the U.S. or their legal status in the U.S. (Garip, 2012; J. Reichert & Massey, 1979), and variability in economic standing appears to be important when considering the later-life health outcomes of return U.S. migrants.

There were mixed results for additive interaction effects between U.S. migration experience and residence characteristics. Whereas the combination of U.S. migration experience and current residence in a high out-migration area was a risk factor for depression, it appears to be protective for diabetes. Reporting U.S. migration experience and current residence in a less urban area was also protective of doctor-diagnosed diabetes later in life. Although I control for some indicators of current economic conditions in these models, it may be that in more rural areas of Mexico or in places that are historically high out-migration states (which also happen to be largely rural), that return U.S. migrants may have greater access to healthcare or health information through their connections to economic and information resources via U.S. migration networks that might help prevent diabetes or support the management of pre-diabetic conditions (Salinas, 2008).[32]

Another compelling finding from this chapter is that there were some significant associations between an indicator that combined measures of family and personal U.S. migration and later-life health outcomes. In a simple analysis it appeared that respondents who were the lone U.S. migrants from their families of origin had significantly greater odds of depression later in life compared to respondents who reported neither personal nor family member migration, although the results did not hold up in multivariable analysis. On the other hand, respondents who reported that they were not U.S. migrants but had either parents or siblings who migrated to

[32] A interesting ancillary finding related to this point is that U.S. return migrants with diabetes are significantly more likely to report treating their diabetes with insulin – over 16% of U.S. return migrant diabetics reported treating their diabetes with insulin compared to 7% of non-U.S. migrants ($p<0.001$). On the other hand, significantly more non-US migrants treat their diabetes with diet alone – 60% of non U.S.-migrants treat their diabetes with diet compared to 49% of U.S. return migrant men. It is possible that this reflects the advanced progression of diabetes among return U.S. migrant men, differences in preference for treatment, or greater access among return U.S. migrant men to insulin and related materials. There were no significant differences in hypertension medication usage by U.S. migration experience.

the U.S were estimated to have significantly higher odds of hypertension later in life compared to their non-U.S. migrant counterparts with no other family member migration. There was also a significant association between having at least one adult child living in the U.S. and increased later-life depressive symptoms using the continuous measure, a finding that held even in a multivariable model. There was no significant association between having an adult child living in the U.S. and later-life hypertension or diabetes, or in depression as indicated by a binary outcome measure.

These results in particular speak more to the potential health effects of being 'left-behind' in Mexico as a non-U.S. migrant within U.S. migrant families than they do to the effects of personal U.S. migration experience. Interpreting the results from joint analysis of family and personal migration is challenging, however, given that it is impossible to tell from the data exactly when family members migrated to the U.S. For example, parental migration to the U.S. might have formed part of respondents' childhood experience; family member migration might have represented temporary or sustained separation along the life-course with later-life health impacts. In addition, while having an adult child living in the U.S. might appear to be a risk factor, at least with the continuous measure of depressive symptoms, there are likely countervailing, positive influences that are supportive of later-life health, including improved financial well-being and access to health care (F. Antman, 2010; Gonzalez Vazquez et al., 2007; Salinas, 2008).

Another set of notable findings from this chapter are reflected in the analysis of U.S .migrant selectivity. Return U.S. migrants report lower levels of education and greater socio-economic disadvantage during childhood. While some accounts of the economic selectivity of

Mexican labor migrants from Mexico to the U.S. tend to suggest that the poorest members of Mexican communities were less likely to migrate initially due to the high “start-up” costs of migration, those with the highest levels of education and greater socio-economic status also tended to stay in Mexico, given less incentive for labor migration to improve their conditions in Mexico (Dinerman, 1982; D. S. Massey, 1987). This latter trend may help explain the descriptive finding that non-U.S. migrants report better socio-economic conditions on average during childhood.

It is slightly more surprising that those who migrated to the U.S. were more likely to report a serious health condition during childhood, given the logic that healthier individuals would have been selected into migration, either by households seeking to make the greatest return on their investment by sending the healthiest (and most employable) member abroad, but also given accounts of rigorous health inspections undertaken by employers seeking to recruit labor migrants during the Bracero era (López Castro, 1986), and other findings of the positive health selection of migrants (E. M. Crimmins et al., 2005; Ullmann et al., 2011). On the other hand, many of the studies that have examined emigrant health selection have looked at adult height as their indicator of early-life health, which might be a better marker of cumulative childhood nutrition and health conditions. It is also possible that acute health conditions during childhood here are indicative of respondents’ socio-economic status, if those who lived in greater poverty in early life were more likely to experience infectious disease for a short time.[33]

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[33] One possibility is that return U.S. migrants were not individually selected as significantly more socio-economically disadvantaged than their fellow communities, but from migrant sending communities that were poorer overall. There is no way to test this, given that the MHAS does not include a measure of whether or not respondents spent their childhood in a high out-migration state or not. Only their current resident characteristics are known. And indeed, there are

Overall, the largely non-significant main effects of personal U.S. migration experience on health brings some insights relevant for immigrant health theory, at least in terms of its relevance for return migrants among middle-aged and older cohorts of Mexican men. The prevailing logic in immigrant health theory is that immigrants are observed to have health advantages relative to their U.S.-born counterparts, with most recent migrants appearing to have the greatest health advantages. There is subsequently an erosion of immigrant health advantages, which has been explained principally as the result of acculturation processes, including shifts in patterns of food consumption and other health behaviors, for but also to the damaging effects of structural and everyday discrimination, poverty, lack of access to healthcare, and the weakening of social support networks that might otherwise serve to help cope with these significant stressors. Through the lens of current immigrant health theories as well as qualitative literature documenting the strain of work and life for Mexican immigrants during the Bracero Era and beyond (de Oca et al., 2011), I predicted that U.S. migration experience would be associated with worse later-life health.

But this analysis is one of *returned* migrants living in Mexico during middle age and later-life. While they might have experienced some of the stressors usually used to explain declining immigrant health status, they may have also retained social networks in families and communities of origin, and experienced other advantages, including average improvements in socio-economic standing relative to what they reported experiencing as children. These

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differences in the selectivity results by whether or not respondents currently live in a high out-migration state or not – return US migrants are more likely to report lacking household sanitation facilities, but are not more likely to report serious childhood illness compared to their non-US migrant counterparts currently living in high US out-migration states, and there are no significant educational differences by US migration experience when stratifying by current residence in a high out-migration state or not. These analyses are of limited utility however, given the issue that current residence does not necessarily reflect respondents' residence pre-migration.

advantages may have countervailing effects on the health impacts of stressors that return migrants experienced in the U.S. The countervailing effect of improved social and economic standing on the experiences exploitation, discrimination, social isolation, and so on, (or at least the memory of these stressors) is reflected in the following passage by the Mexican ethnographer Gustavo López Castro in his study of the effects of U.S. migration on a village in Michoacán, México:

> "*Él que regresa olvida que lo asaltaron los cholos en Tijuana, que a los oficiales migratorios mexicanos les tuvo que dar cierta cantidad de dinero para que no lo 'confundieran' con centroamericano, que la patrulla fronteriza lo deportó en dos ocasiones antes de lograr llegar a Watsonville, que una vez allí no pudo trabajar dos semanas debido a la lluvia, que cuando regresó tuvo que darle una 'mordida' al resguardo aduanal de Mexicali para que le permitieran pasar una grabadora, ropa y algún juguete para sus hijos, todo lo cual finalmente le decomisaron al terminar la zona libre en Benjamin Hill, Sonora. Todo lo olvida y solo platica de lo bien que se paga el trabajo mexicano en Estados Unidos, de lo que le rindieron los dólares que pudo ahorrar, y de que nomás pasando la fiesta de los Santos Reyes se irá nuevamente*" (p. 110).

> *"He who returns forgets that the* cholos *assaulted him in Tijuana, that he had to give a certain quantity of money to the Mexican migration officials so that they did not 'confuse' him with a Central American, that the border patrol deported him on two occasions before he arrived in Watsonville, that once he got there he couldn't work for two weeks because of the rain, that when he returned he had to give a 'little bite' (a bribe) to the customs guards in Mexicali so that they would allow him to come through with a recorder, clothing, and a toy for his kids, all of which they ultimately seized at the end of the free zone in Benjamin Hill, Sonora. He forgets everything and only chats about how well they pay Mexican work in the United States, of that which yielded the dollars that he was able to save, and that once the Santos Reyes celebrations pass he will return once again" (p.110, my translation).*

This passage suggests that the stressful experiences of U.S. migration were often forgotten once migrants return to their home communities, where U.S. migration was framed as a largely positive experience – and one that many U.S. migrants planned to repeat soon after return back to Mexico. A more recent set of findings from qualitative research with older return migrant men in Mexico reflects a similar phenomenon as documented by López Castro's passage, and as suggested by my results: many return U.S. migrants may experience stressors that are often cited as likely determinants of immigrant health decline, including harsh and unfair work conditions, every day discrimination, and the challenges of crossing the border. But these experiences may not continue to be experienced as stressors once back in communities of origin, given a sense of financial well-being relative and improved access to health care relative to return migrants' own early life conditions *and* relative to their non-US migrant community members (Gonzalez Vazquez et al., 2007; V.N. Salgado de Snyder, 2007).

The combination of elevated social and economic status for return US migrants and potential for 'forgetting' some of the less desirable experiences during migration may be one explanation for the largely non-significant main effects of U.S. migration experience on the later-life health of middle-aged and older Mexican men, along with the relative similarity between U.S. return migrants and non U.S.-migrants in terms of socio-economic status and access to healthcare – both important determinants of later-life health. On the other hand, as I have shown with the results from additive interaction effects, there is still variability in the socio-economic standing that return U.S. migrants report later in life, and there are significant differences in the effects of U.S. migration on some health outcomes based on these socio-economic differences.

4.9 Tables

Table 4.1. Baseline descriptive statistics for older Mexican men in Mexico, based on spousal migration history to the US. (n=5827)

	No migration (n=4780)	Migrated to the US (n=935)	Returned to Mexico >29 years ago (n=531)	Migrated to the US more than once (n=398)	Spent > 5 years in the US (n=266)
Age, mean	61.8 (9.4)	64.6 (9.4)	68.2 (8.7)	64.3 (9.6)	65.5 (9.5)
		$p<0.001$			
Urban residence	3174 (66.4)	531 (56.8)	302 (56.9)	186 (46.7)	157 (59.0)
		χ^2=31.7, $p<0.001$			
High out-migration state	1147 (24.0)	425 (45.5)	226 (42.6)	219 (55.0)	117 (43.9)
		χ^2=180.6, $p<0.001$			
Marital History					
Current marital status					
Married	3993 (83.5)	763 (81.6)	412 (77.6)	326 (81.9)	210 (79.0)
Widowed	412 (8.6)	86 (9.2)	71 (13.4)	25 (6.3)	22 (8.3)
Divorced/Separated	243 (5.1)	67 (7.2)	37 (6.9)	39 (9.8)	27 (10.2)
Never married	132 (2.8)	19 (2.0)	11 (2.1)	8 (2.0)	7 (2.6)
		χ^2=8.48, $p<0.05$			
Early-life SES and health					
Before age 10:					
No household sanitation	3219 (67.5)	717 (76.9)	417 (78.9)	194 (72.9)	317 (79.9)
		χ^2=32.4, $p<0.001$			
Serious health problem	488 (10.3)	133 (14.3)	68 (12.9)	30 (11.4)	59 (14.9)
		χ^2=12.9, $p<0.001$			
Often went to bed hungry	1370 (35.2)	246 (33.0)	140 (33.3)	61 (30.4)	99 (30.8)
		χ^2=1.34, $p=0.25$			
Mother had no education	2517 (52.8)	486 (52.0)	285 (53.8)	218 (54.9)	128 (48.1)
Don't know mother's education	400 (8.4)	114 (12.2)	70 (13.2)	50 (12.6)	31 (11.7)
		χ^2=14.6, $p<0.01$			
R had no education	1015 (20.8)	235 (25.1)	142 (26.7)	57 (21.4)	100 (25.1)
		χ^2=8.96, $p<0.01$			
Father worked in agricultural, domestic, no work	2179 (56.3)	506 (67.9)	291 (69.3)	240 (74.5)	136 (67.7)
Construction	564 (14.6)	71 (9.5)	41 (9.8)	24 (7.5)	17 (8.5)
Garden	374 (9.7)	58 (7.8)	30 (7.1)	20 (6.2)	16 (8.0)
Restaurant	252 (6.5)	40 (5.4)	24 (5.7)	16 (5.0)	13 (6.5)
Office or other	329 (8.5)	42 (5.6)	21 (5.0)	13 (4.0)	12 (6.0)
Don't know or no parents	174 (4.5)	28 (3.8)	13 (3.1)	9 (2.8)	7 (3.5)
		χ^2=36.8, $p<0.001$			
Occupational History					
Primary occupation					
Domestic	577 (12.2)	73 (10.9)	48 (9.1)	36 (9.1)	27 (10.2)
Factory	825 (17.4)	81 (12.1)	70 (13.2)	34 (8.6)	36 (13.6)

	Service	1081 (22.8)	155 (23.2)	122 (23.1)	90 (22.7)	61 (23.0)
	Agricultural	1258 (26.5)	266 (39.9)	217 (41.0)	195 (49.2)	104 (39.3)
	Professional	976 (20.6)	91 (13.6)	72 (13.6)	40 (10.1)	37 (14.0)
	Never worked	29 (0.6)	1 (0.2)	0 (0.00)	1 (0.3)	
		χ^2=82.07, p<0.001				
Adult SES						
	Number of items in household, mean (SD)	4.14 (1.86)	4.47 (1.59)	4.40 (1.66)	4.36 (1.57)	4.75 (1.44)
		p<0.01				
	Poor self-rated economic conditions	3739 (78.6)	754 (80.9)	436 (82.4)	327 (82.8)	208 (78.5)
		χ^2=2.42, p=0.12				
	Bottom half of monthly income	2207 (45.1)	463 (49.5)	288 (54.2)	204 (51.3)	124 (46.6)
		χ^2=3.51, p=0.06				
	Bottom half of net assets	2109 (43.1)	397 (42.5)	236 (44.4)	160 (40.2)	95 (35.7)
		χ^2=0.88, p=0.35				
Family Migration to U.S.						
	Siblings or parents migrated to U.S.	1154 (25.7)	517 (57.4)	263 (52.0)	254 (66.0)	171 (66.8)
		χ^2=350.9, p<0.001				
	At least one child lives in U.S.	866 (17.7)	402 (43.0)	196 (36.9)	210 (52.8)	147 (55.3)
		χ^2=294.9, p<0.001				
Source: Mexican Health and Aging Study, 2001 and 2003.						

Table 4.2. Descriptive health statistics for older Mexican men in Mexico, based on migration history to the U.S. (n=5827)					
	No migration (n=4780)	**Migrated to the US (n=935)**	Returned to Mexico >29 years ago (n=531)	Migrated to the US more than once (n=398)	Spent > 5 years in the US (n=266)
Diagnosed with hypertension	1353 (29.4)	283 (31.2)	172 (33.4)	117 (30.4)	73 (28.3)
		χ^2=1.24, p=0.26			
Had test for hypertension in past two years	3154 (66.0)	621 (66.4)	356 (68.7)	264 (66.3)	181 (68.1)
		χ2=0.06, p=0.80			
Diagnosed with diabetes	667 (14.5)	122 (13.4)	73 (13.8)	44 (11.4)	30 (11.6)
		χ2=0.70, p=0.40			
Had test for diabetes in past two years	2741 (57.4)	525 (56.2)	320 (61.8)	206 (51.8)	154 (57.9)
		χ2=0.46, p=0.50			
Past-week depressive symptoms, 2001					
Depressed (≥ 5 symptoms)	1287 (27.2)	263 (28.9)	166 (31.3)	104 (26.9)	67 (25.9)
		χ2=1.08, p=0.30			
Mean (SD)	2.93 (2.45)	3.15 (2.49)	3.34 (2.51)	3.10 (2.45)	2.96 (2.44)
Other health measures					
Body Mass Index					
Underweight/Normal (24.9 or below)	1305 (27.6)	280 (30.7)	167 (31.5)	126 (32.6)	93 (35.9)
Overweight (25-29.9)	1760 (37.2)	334 (36.7)	187 (35.2)	137 (35.4)	92 (35.5)
Obese (29.9 or above)	793 (16.8)	137 (15.0)	77 (14.5)	55 (14.2)	36 (13.9)
Missing	875 (18.5)	160 (17.6)	100 (18.8)	69 (17.8)	38 (14.7)
		χ2=4.50, p=0.02			
Smoking status					
Never smoked	1668 (34.9)	239 (25.6)	136 (25.6)	104 (26.1)	67 (25.2)
Former smoker	1842 (38.6)	416 (44.5)	249 (46.9)	178 (44.7)	118 (44.4)
Current smoker	1266 (26.5)	280 (29.9)	146 (27.5)	116 (29.2)	81 (30.5)
		χ2=30.9, p<0.001			
Currently use alcohol	2311 (48.4)	439 (47.1)	230 (43.4)	178 (44.8)	130 (49.2)
		χ2=0.54, p=0.46			
Insurance coverage, 2001	2871 (62.2)	508 (55.8)	310 (58.5)	185 (47.9)	138 (53.3)
		χ2=12.99, p<0.001			
No usual source of medical care, 2001	1587 (34.6)	313 (34.6)	179 (33.9)	148 (38.4)	91 (35.1)
		χ2<0.01, p=0.99			
Source: Mexican Health and Aging Study, 2001 and 2003.					

Table 4.3. Simple logistic regression models of depression, hypertension and diabetes for older Mexican men by US migration history.

	Five or more depressive symptoms (n=5715)			Doctor-diagnosed hypertension (n=5517)			Doctor Diagnosed Diabetes (n=5520)		
Binary (Ref = No US migration experience)	OR		95% CI	OR		95% CI	OR		95% CI
US return migrant	1.19	*	(1.02, 1.39)	1.09		(0.94, 1.27)	0.92		(0.74, 1.13)
Respondent and family migration experience (Ref=Neither R nor family migrated)									
R did not migrate, family did	1.02		(0.88, 1.19)	1.19	*	(1.04, 1.39)	1.07		(0.89, 1.29)
R migrated, family did not	1.35	**	(1.08, 1.68)	1.21		(0.97, 1.51)	0.92		(0.68, 1.25)
Both R and family migrated	1.06		(0.86, 1.31)	1.09		(0.89, 1.34)	0.93		(0.71, 1.23)
Adult kid in US									
Three-category models (Ref=No migration experience)									
≤ 29 years since migration (more recent migration)	0.94		(0.73, 1.20)	0.95		(0.76, 1.19)	0.93		(0.73, 1.18)
> 29 years since migration (more distant migration)	1.35	**	(1.11, 1.64)	1.16		(0.96, 1.41)	0.84		(0.62, 1.12)
One trip abroad only	1.33	**	(1.09, 1.63)	1.12		(0.91, 1.37)	1.06		(0.81, 1.37)
More than one trip abroad	1.03		(0.81, 1.31)	1.08		(0.86, 1.36)	0.77		(0.55, 1.07)
≤ 5 years abroad	1.26	*	(1.05, 1.50)	1.15		(0.97, 1.37)	0.97		(0.77, 1.23)
> 5 years abroad	1.02		(0.77, 1.35)	0.95		(0.72, 1.25)	0.77		(0.52, 1.14)

Source: Mexican Health and Aging Study, 2001, *p<0.05, **p<0.01, ***p<0.001

Table 4.4. Simple linear regression of depressive symptoms for older Mexican men by US migration history.			
	Depressive symptoms (0-9), 2001 (n=5715)		
Binary (Ref = No US migration experience)	B		SE
US return migrant	0.21	*	(0.09)
Respondent and family migration experience (Ref=Neither R nor family migrated)			
R did not migrate, family did	-0.07		(0.08)
R migrated, family did not	0.36	**	(0.13)
Both R and family migrated	0.04		(0.12)
Adult kid in US	0.34	***	(0.08)
Three-category models (Ref=No migration experience)			
≤ 29 years since migration (more recent migration)	-0.12		(0.11)
> 29 years since migration (more distant migration)	0.42	***	(0.13)
One trip abroad only	0.29	*	(0.12)
More than one trip abroad	0.11		(0.13)
≤ 5 years abroad	0.29	**	(0.10)
> 5 years abroad	<0.01		(0.18)

Source: Mexican Health and Aging Study, 2001 and 2003, *p<0.05, **p<0.01, ***p<0.001.

Table 4.5. Multivariate model of past-week depression for older Mexican men by personal migration history and time since last migration to the US (n=5715)									
	Add Demographics			Add Childhood Circumstances			Add Adult SES		
	OR		95% CI	OR		95% CI	OR		95% CI
Personal Migration History (Ref=No US migration)									
US migration, ≤ 29 years ago	0.89		(0.69, 1.14)	0.88		(0.67, 1.17)	0.89		(0.99, 1.79)
US migration, >29 years ago	1.07		(0.87, 1.31)	1.31		(0.98, 1.75)	1.34		(0.67, 1.17)
Demographics									
< 60 years old (Ref = 60 years or more)	0.66	***	(0.58, 0.75)	0.72	***	(0.62, 0.84)	0.74	***	(0.64, 0.86)
Urban residence	0.74	***	(0.66, 0.84)	0.90		(0.76, 1.06)	1.05		(0.89, 1.27)
High out-migration state	1.29	***	(1.13, 1.48)	1.15		(0.98, 1.35)	1.22	*	(1.03, 1.44)
Marital Status (Ref=Married)									
Single	1.20		(0.83, 1.73)	1.12		(0.71, 1.76)	1.10		(0.70, 1.75)
Divorced/Separated	1.75	***	(1.37, 2.24)	1.11		(0.81, 1.52)	0.98		(0.71, 1.35)
Widowed	2.16	***	(1.78, 2.63)	1.68	**	(1.22, 2.31)	1.63	**	(1.18, 2.25)
Early Childhood (possible selection criteria)									
No education				1.74	***	(1.40, 2.16)	1.55	***	(1.24, 1.95)
No sanitation in household before age 10				1.55	***	(1.33, 1.81)	1.31	**	(1.12, 1.55)
Serious health condition before age 10				1.40	**	(1.09, 1.80)	1.33	*	(1.04, 1.71)
Adult Socio-economic Status									
Agricultural or domestic work							0.99		(0.83, 1.19)
Number of household items							0.92	**	(0.86, 0.97)
Poor self-rated economic situation							2.06	***	(1.75, 2.42)
LR Chi-squared	**184.5**	*******		**172.1**	*******		**263.2**	*******	
Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.001									

Table 4.6. Multivariate model of past-week depression for older Mexican men by personal migration history (n=5715)									
	Add Demographics			**Add Childhood Circumstances**			**Add Adult SES**		
	OR		95% CI	OR		95% CI	OR		95% CI
US return migrant[a]	1.02		(0.86, 1.20)	0.98		(0.83, 1.16)	1.08		(0.88, 1.33)
LR Chi-squared	**110.5**	*******		**275.6**	*******		**260.2**	*******	

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.001. Note. Ref=No US migration experience.

Table 4.7. Multivariate model of past-week depression for older Mexican men by personal migration history and cumulative time in the US (n=5666)									
	Add Demographics			**Add Childhood Circumstances**			**Add Adult SES**		
	OR		95% CI	OR		95% CI	OR		95% CI
Personal Migration History[a]									
≤ 5 years abroad	0.81		(0.59, 1.12)	0.81		(0.58, 1.12)	0.85		(0.61, 1.19)
> 5 years abroad	1.26		(0.99, 1.61)	1.19		(0.93, 1.53)	1.21		(0.95, 1.56)
LR Chi-squared	**81.6**	*******		**170.5**	*******		**263.2**	*******	

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.001. Note: A. Ref = No US migration experience.

Table 4.8. Multivariate model of past-week depression for older Mexican men by personal migration history and number of trips abroad (n=5614)										
		Add Demographics			**Add Childhood Circumstances**			**Add Adult SES**		
		OR		95% CI	OR		95% CI	OR		95% CI
Personal Migration History[a]										
	One trip to the US	0.83		(0.65, 1.07)	0.80		(0.63,1.03)	0.82		(0.63, 1.06)
	More than one trip to the US	1.18		(0.96, 1.45)	1.14		(0.92, 1.40)	1.19		(0.63, 1.06)
LR Chi-squared		**81.6**	*******		**170.5**	*******		**263.2**	*******	

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.001. Note. A: Ref = No US migration experience

Table 4.9. Multivariate model of doctor-diagnosed hypertension for older Mexican men by personal migration history and time since last migration to the US										
		Depression (n=5645)			**Diabetes (n=5457)**			**Hypertension (n=5472)**		
		OR		95% CI	OR		95% CI	OR		95% CI
R and family migration experience[a]										
	R did not migrate, family did	1.18	*	(1.00, 1.49)	1.03		(0.84, 1.25)	1.18	*	(1.01, 1.37)
	R migrated, family did not	1.14		(0.90, 1.44)	0.94		(0.69, 1.28)	1.14		(0.91, 1.43)
	Both R and family migrated	1.01		(0.81, 1.27)	0.91		(0.69, 1.22)	1.01		(0.82, 1.25)
LR Chi-squared		**304.9**	*******		**95.6**	*******		**110.2**	*******	

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.001. Note: A. **Ref=Neither R nor family migrated**

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Table 4.10. Multivariable OLS models of depressive symptoms for older Mexican men by US migration history.			
	Depressive symptoms (0-9), 2001 (n=5715)		
Binary (Ref = No US migration experience)	B		SE
US return migrant	-0.01		(0.09)
Respondent and family migration experience (Ref=Neither R nor family migrated)			
R did not migrate, family did	0.12		(0.08)
R migrated, family did not	0.08		(0.12)
Both R and family migrated	-0.04		(0.11)
Kid in US	-0.16	*	(0.08)
Three-category models (Ref=No migration experience)			
≤ 29 years since migration (more recent migration)	0.05		(0.11)
> 29 years since migration (more distant migration)	-0.16		(0.13)
One trip abroad only	0.11		(0.11)
More than one trip abroad	-0.21		(0.13)
≤ 5 years abroad	0.04		(0.15)
> 5 years abroad	-0.14		(0.10)

Source: Mexican Health and Aging Study, 2001 and 2003, *p<0.05, **p<0.01, ***p<0.001. Note: Controlling for demographic and residence characteristics, and childhood and adult socio-economic indicators.

Table 4.11. Multivariable model predicting whether or respondent migrated to the US to live or work, for a nationally representative sample of Mexican men born before 1951 (n=5667)

	OR		95% CI
50-59 years old (ref=60 years and older)	0.78		(0.59, 1.03)
Years exposed to Bracero Era[a]	1.02	**	(1.01, 1.04)
R received no formal education	0.95		(0.79, 1.13)
R's mother received no formal education	1.05		(0.93, 1.19)
Serious illness before age 10	1.48	***	(1.20, 1.82)
No sanitation in household before age 10	1.45	***	(1.22, 1.73)
LR Chi-squared	**114.7**	*******	

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.001 Notes: a. With potential years of exposure starting at 16 years old, which is just below the average age of first marriage for the sample, for the Bracero period starting in 1942 and ending in 1964

Table 4.12. Average treatment effects of US migration on depression, hypertension and diabetes for older Mexican men with and without histories of migration to the US

	Depression (n=5667)	Hypertension (n=5653)	Diabetes (n=5669)
Average treatment effects (ATE)	0.005	-0.16	-0.01
Average treatment effects on the treated (ATET)	0.005	-0.003	-0.02

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00. Notes: Variables used to construct propensity scores are years of exposure to the Bracero Era, and childhood socio-economic and health status.

Table 4.13. Relative risk ratios for logistic regression model of depression for older Mexican men by US migration history with interactions by labor history, (n=5634)[a]

	RR		95% CI
Interactions with SES			
US migrant	1.04		(0.67, 1.62)
Poor self-rated economic situation	1.99	***	(1.63, 2.43)
US migrant and poor self-rated economic situation	2.03	***	(1.58, 2.60)
US migrant	0.89		(0.70, 1.12)
Bottom half of net assets	1.14		(0.99, 1.32)
US migrant and bottom half of net assets	1.37	*	(1.08, 1.74)
US migrant	0.93		(0.73, 1.19)
Bottom half of monthly income	1.21	**	(1.05, 1.40)
US migrant and bottom half of monthly income	1.35	*	(1.07, 1.70)
Interactions with Residence			
US migrant	0.93		(0.72, 1.20)
Lives in urban area	1.02		(0.87, 1.21)
US migrant and lives in urban area	1.13		(0.88, 1.44)
US migrant	0.94		(0.75, 1.19)
Lives in high out-migration state	1.29	**	(1.10, 1.51)
US migrant and high out-migration state	1.47	**	(1.17, 1.84)
Interactions with Family Migration			
US migrant	1.15		(0.90, 1.47)
US migrant family member	1.23	*	(1.04, 1.45)
US migrant and US migrant family member	1.05		(0.84, 1.32)

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status and childhood and adult SES characteristics

Table 4.14. Relative risk ratios for logistic regression model of hypertension for older Mexican men by US migration history with interaction, (n=5149)[a]

		RR		95% CI
US migrant		0.96		(0.67, 1.38)
Poor self-rated economic situation		1.23	*	(1.04, 1.45)
	US migrant and poor self-rated economic situation	1.27	*	(1.02, 1.59)
US migrant		1.15		(0.90, 1.45)
US migrant family member		1.20	*	(1.03, 1.40)
	US migrant and US migrant family member	1.02		(0.83, 1.27)

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status and childhood and adult SES characteristics

Table 4.15. Relative risk ratios for logistic regression model of diabetes for older Mexican men by US migration history with interactions (n=5447)[a]

		RR		95% CI
US migrant		0.66	*	(0.44, 0.99)
Lives in urban area		1.08		(0.88, 1.33)
	US migrant and lives in urban area	1.16		(0.86, 1.56)
US migrant		1.04		(0.80, 1.36)
Lives in high out-migration state		0.95		(0.78, 1.15)
	US migrant and high out-migration state	0.71	*	(0.51, 0.99)

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status and childhood and adult SES characteristics

Table 4.16. Four-by-four table of risk ratios of depression for additive interaction analysis of US migration and self-rated financial situation for older Mexican men

	Return US migrant	
Poor Self-Rated Financial Situation	No	Yes
No	*Ref*	1.04, NS
Yes	1.99, p<0.001	2.03, p<0.001

Source: Mexican Health and Aging Study, 2001. Controlling for age, residence characteristics and childhood and adult SES characteristics

Table 4.17. Four-by-four table of risk ratios of depression for additive interaction analysis of US migration experience and reporting below median net assets for older Mexican men

	Return US migrant	
Below Median on Net Assets	No	Yes
No	*Ref*	0.89, NS
Yes	1.14, NS	1.37, p<0.05

Source: Mexican Health and Aging Study, 2001. Controlling for age, residence characteristics and childhood and adult SES characteristics

Table 4.18. Four-by-four table of risk ratios of hypertension for additive interaction analysis of US migration and self-rated financial situation for older Mexican men

	Return US migrant	
Poor Self-Rated Financial Situation	No	Yes
No	*Ref*	0.96, NS
Yes	1.23, p<0.05	1.27, p<0.05

Source: Mexican Health and Aging Study, 2001. Controlling for age, residence characteristics and childhood and adult SES characteristics

Table 4.19. Four-by-four table of risk ratios of depression for additive interaction analysis of US migration and living in a high US out-migration state for older Mexican men

	Return US migrant	
High Out Migration State	No	Yes
No	*Ref*	0.94, NS
Yes	1.29, p<0.05	1.47 p<0.001

Source: Mexican Health and Aging Study, 2001. Controlling for age, residence characteristics and childhood and adult SES characteristics

Table 4.20. Four-by-four table of risk ratios of diabetes for additive interaction analysis of US migration and living in a high US out-migration state for older Mexican men

	Return US migrant	
High Out Migration State	No	Yes
No	*Ref*	1.04, NS
Yes	0.95, NS	0.71, p<0.05

Source: Mexican Health and Aging Study, 2001. Controlling for age, residence characteristics and childhood and adult SES characteristics

Table 4.21. Summary Table of Regression Results For Analyses of US Migration Experience and Later-Life Health for Older Men in Mexico

		Outcome			
Key Predictor	**Type of Analysis**	**Depression - Binary**	**Depressive Symptoms - Continuous**	**Hypertension**	**Diabetes**
US return migrant (ref = no US migration experience)	Bivariate	OR: 1.19, p<0.05	B: 0.21, p<0.05	NS	NS
One trip or more than one trip (ref = no US experience)	Bivariate	OR: 1.33, p<0.01 for one trip only	B: 0.29, p<0.05 for one trip only	NS	NS
More than 29 years or ≤ 29 years since return (ref=no US experience)	Bivariate	OR: 1.35, p<0.01 for > 29 yrs only	B: 0.42, p<0.001 for >29 years	NS	NS
More than 5 years or ≤ 5 years abroad (ref=no US experience)	Simple	OR: 1.26, p<0.05 for ≤ 5 years	B: 0.29, p<0.01 for ≤ 5 years	NS	NS
US return migrant (ref = no US migration experience)	Multivariable	NS	NS	NS	NS
One trip or more than one trip (ref = no US experience)	Multivariable	NS	NS	NS	NS
More than 29 years or ≤ 29 years since return (ref=no US experience)	Multivariable	NS	NS	NS	NS
More than 5 years or ≤ 5 years abroad (ref=no US experience)	Multivariable	NS	NS	NS	NS
Interaction Effects					
US migrant+More Urban Residence	Multivariable-Additive Interactions	NS	NA	NS	NS
US migrant+High US Out-Migration State	Multivariable-Additive Interactions	OR: 1.45, p<0.01	NA	NS	OR: 0.71, p<0.05
US migrant+Poor Self-Rated Economic Situation	Multivariable-Additive Interactions	OR: 2.03, p<0.001	NA	OR: 1.27, p<0.05	NS
US migrant+Bottom Half of Net Assets	Multivariable-Additive Interactions	OR: 1.37, p<0.05	NA	NS	NS
US migrant+Bottom Half of Monthly Income	Multivariable-Additive Interactions	OR: 1.35, p<0.05	NA	NS	NS
US migrant+More Urban Residence	Multivariable-Multiplicative Interactions	NS	NS	NS	NS
US migrant+High US Out-Migration State	Multivariable-Multiplicative Interactions	NS	NS	NS	NS
US migrant+Poor Self-Rated Economic Situation	Multivariable-Multiplicative Interactions	NS	NS	NS	NS

US migrant+Bottom Half of Net Assets	Multivariable-Multiplicative Interactions	NS	NS	NS	NS
US migrant+Bottom Half of Monthly Income	Multivariable-Multiplicative Interactions	NS	NS	NS	NS
Family US Migration					
Respondent and family migration experiences (ref = neither R nor family migrated)	Bivariate	OR: 1.35, p<0.01 respondent US migrant/family non-US migrant	B:0.36, p<0.01 respondent non-US migrant, family US migrant	OR: 1.19, p<0.05 respondent non-US migrant/family US migrant	NS
Respondent and family migration experiences (ref = neither R nor family migrated)	Multivariable	OR: 1.18, p<0.05 respondent non-US migrant/family US migrant	NS	OR: 1.18, p<0.05 respondent non-US migrant/family US migrant	NS
Respondent has at least one child in the US (ref = no child in US)	Bivariate	OR: 1.16, p<0.05	B:0.33, p<0.001	NS	NS
Respondent has at least one child in the US (ref = no child in US)	Multivariable	NS	B:0.16, p<0.05	NS	NS
Source: Mexican Health and Aging Study, 2001					

Chapter 5: Spousal U.S. Migration and Health for Older Mexican Women

5.1 Introduction

The objective of this chapter is to describe the relationship between spousal migration to the U.S. and later-life health outcomes for middle-aged and older Mexican women. To review, I am drawing on theories of the life-course, cross-border ties, and gender and power theories as applied to migration to suggest that spousal migration to the U.S. may matter for the health of women in Mexico, even if that migration occurred much earlier on in the life-course, and even if women themselves were not migrants to the U.S. I hypothesize that women whose spouses migrate to the U.S. will have higher rates of depression, diabetes, and hypertension in middle-age and older adulthood, even accounting for some of the potential benefits of spousal migration to the U.S. (e.g. improved socio-economic conditions, expanded power over decision-making and earnings within the family while the spouse is away). I hypothesize that some of this adverse effect will be explained by the fact that women with spouses who migrated to the U.S. to live or work for any period of time may also be more likely to report raising children alone – one aspect of the increased burden that women face when their husbands leave them behind (Dinerman, 1982; Mummert, 1988). I also expect that the effect of spousal migration to the U.S. on women's later-life health will be dependent on dimensions of women's own labor and power – including their occupational histories, their ability to make decisions within their own families, and their sense of personal control or mastery.

5.2 Descriptive statistics

The MHAS collected data from female respondents on whether or not their spouses ever went to live and work in the U.S., only if those respondents were not currently married (i.e. widowed, divorced, or separated). This means that for those women currently married, spousal migration history must be captured from their spouse's own interviews. This creates two categories of women whose spouses migrated to the U.S. – those who are divorced, widowed, or separated, and those currently married and living with their spouses. While the objective of this chapter is to examine the effect of spousal migration to the U.S. on later-life health outcomes for older women in Mexico, differences in demographic characteristics by both spousal migration history AND current marital status suggest that both factors need to be taken into account simultaneously.

Table 5.1 presents demographic differences by the overarching categories of spousal migration to the U.S., but also by sub-categories within these groups based on current marital status. There are qualitatively large and significant differences across most demographic, family, and SES variables by categories of spousal migration to the U.S. and current marital status. About 75% of women not currently in a union report ever working in their lifetime, regardless of spousal migration history, while only 56% of those currently married whose spouses also migrated to the U.S. ever worked. Similarly, between 22% and 25% of women not in a union at the baseline survey reported working doing domestic labor, while only 12% to 15% of those currently married reported the same.

The numbers on labor would make it seem as though the differences in this sample seem to lie more with marital status than with histories of spousal migration to the U.S. However, the indicator of whether or not women reported raising their children alone suggests otherwise. While women who were widowed, divorced, or separated at baseline were more likely to report raising children alone regardless of spousal migration to the U.S., nearly 66% of those both not in a union and reporting spousal migration history reported a period of raising children alone compared to the 41% not in a union but with no spousal migration history. In other words, those who are not currently in a union faced greater burdens of work in and outside the home over their life-course, but these burdens appear to be even greater if their spouse also migrated to the U.S.

In terms of current residence, it seems that who are not in a current union are also more likely to be living in urban areas compared to their married counterparts, regardless of spousal migration history. On the other hand, both married and unmarried women who report a history of spousal migration to the U.S. are more likely to living in one of the six historically high out-migration states oversampled as part of the baseline study. Women with a history of spousal migration are also more likely to have their own history of migration to the U.S. (followed by return back to Mexico): 10% of women with a history of spousal migration to the U.S. also went to the U.S. to work or live across categories of marital status, compared with 2% of those with no spousal migration history. Rates of internal migration, on the other hand, were highest for women both currently married and with a history of spousal migration to the U.S. (68%), and lowest for those not currently in a union and with spousal migration history (57%).

Finally, those with spouses who migrated to the U.S. – themselves more likely to have gone abroad and more likely to reside in historically high out-migration states—were more likely to have family members that have immigrated to the U.S. to live or work, including parents, siblings, and children. Over 40% of respondents whose spouses migrated to the US reported that their parents and/or siblings had also migrated to the U.S. compared to around 20% of those with no spousal migration to the U.S. The figures were similar for the percentage of respondents who had at least one adult child living or working in the U.S. at the time of the survey: up to 48% of respondents who reported that their spouses migrated to live or work in the U.S. also reported having an adult child currently living in the U.S. compared to around 20% of those with no spousal U.S. migration history.

All groups categorized by spousal migration history and marital status were similar on indicators of education, having a serious health problem before age 10, and reporting frequent hunger before age 10 – all indicators of childhood socio-economic and health conditions that may influence the selection of individual women into marriages with and without histories of migration to the U.S. However, about 64% of those with no spousal migration history to the US, and 74% of those with a history of spousal migration to the U.S. reported having no sanitation facilities in their household before age 10, suggesting a context of more disadvantaged material conditions for those in marriages that did not involve migration to the U.S. It may be important to control for this particular indicator of early childhood material conditions and health context, given that these early-life (and pre-marriage) conditions may also influence later-life health outcomes.

The final set of descriptive statistics in this table report on current economic and material conditions. Across categories of marital status and history of spousal migration to the U.S., respondents report a similar number of household items (slightly more than four, on average). They also give similar ratings of their subjective economic situation, with around 80% reporting insufficient funds to meet basic needs. There is a greater variability when it comes to reporting monthly incomes and net assets that fall in the bottom two quartiles, based on the overall baseline sample. Around 57% of respondents who are married report being in the bottom two quartiles of monthly income, whereas the figure is *lower* for those who are currently widowed, divorced, or separated (52% of those with no spousal migration history and 50% of those with spousal migration history). It may be that women in particular who are not in a union receive more monthly contributions from their children and other family members than those who are married and combine resources with their spouse. On the other hand, women who are not in a union have fewer total assets to their name compared to their counterparts in a union, regardless of spousal migration history. Well over half of respondents not in a union report being in the bottom quartiles of wealth as constructed from the overall sample, whereas 40% of those in a union report being relatively disadvantaged in terms of their total assets.

Table 5.2 shows descriptive statistics for the outcomes variables for my analysis. On the descriptive level, there appear to be important differences in health outcomes by both history of spousal migration to the U.S. and current marital status – with the most adverse health outcomes reported by those whose spouses migrated to the U.S. *and* who are not currently married. Around 45% of women with no spousal migration history (regardless of marital status) and 48% of those whose spouses migrated to the U.S. but are currently married reported ever being diagnosed with hypertension. This compares to the 57% of women who reported not being in a current union and spousal migration to the U.S. that reported doctor-diagnosed hypertension. Similarly, 17% with no spousal migration history reported ever being diagnosed with diabetes while a full quarter of those with both spousal migration *and* no current union reported a doctor diagnosis of diabetes. It should be noted, however, that women with some history of spousal migration—and those who are not currently in a union, in particular—are significantly more likely to report having had recent tests for hypertension and diabetes.

Results are a bit more varied for the measure of past-week depressive symptoms. At first glance, the trends in past-week depressive symptoms appear to be more closely related to current marital status: around 40% of those currently married report five or more past-week depressive symptoms, regardless of spousal migration to the U.S. Among those not currently in a union, 49% of those with no spousal migration history report symptoms consistent with past-week depression and 55% of those with spousal migration to the U.S. report the same.

5.3 Simple Statistics

Table 5.3 reports results from simple logistic regression analysis for all three-outcome variables using only the four-category measure of both spousal migration history and current marital status. The results for depression suggest that respondents not in a current union – both those who report spousal migration history and those who do not – have significantly greater odds of reporting five or more past-week depressive symptoms compared with those who are both currently married and reported no spousal migration history, which is the reference group (OR: 1.44, 95% CI: 1.28, 1.61, for those with no spousal migration history; OR: 1.85, 95% CI: 1.47, 2.32, for those with spousal migration history). There was no significant difference in the odds of depression for those who reported spousal migration to the U.S. *and* are currently married compared to their counterparts who are also married but have no history of spousal migration to the U.S. Again, it appears that the odds of depression, based on a cut-off of five or more past-week depressive symptoms, is more closely linked to current marital status than respondents' experience with spouses migration to the U.S., although further analyses stratified by marital status are necessary to make this conclusion; I present these results below.

For the analyses of doctor-diagnosed hypertension and diabetes, respectively, the only group that has significantly greater odds of reporting these conditions compared to the currently married/no spousal migration history reference category is the group that is both currently not in a union *and* reports a history of spousal migration to the U.S. This is reflective of the descriptive statistics, which suggest that this group of respondents who experienced spousal migration to the U.S. and are currently divorced, separated, or widowed, are the most disadvantaged in terms of their current chronic disease outcomes.

Table 5.4 presents results from logistic regression analyses of the association between spousal migration and each of the dependent health outcomes, stratified by current marital status. This allows a more direct look at the association between spousal migration to the U.S. and each of the health outcomes within groups of respondents that are currently in a union or not. The results here suggest that there are significant associations between spousal migration to the U.S. and hypertension, and diabetes. respectively, but only for those who are not currently in a union.[34][35] Table 5.5 shows analyses of the relationship between spousal migration to the U.S. and a continuous measure of depression, which reflect the same qualitative results as with models using the binary measure of depression. That is, marriage appears to be predictive of later-life depression, but not spousal migration to the U.S.[36]

These stratified analyses are more to the point in terms of limiting analyses of spousal migration history and health to specific groups that are similar in terms of current marital status, allowing me to tease apart the effects of spousal migration from the effects of current marital status. However, I often choose to use the composite measure that combines the effects of

[34] In multivariable analyses below I further stratify by whether or not respondents are divorced/separated versus widowed, since these are quite different phenomenon.

[35] For those currently in a union, I also try the regression analyses restricted to those married only once to be sure that the migrant spouse is also their current migrant spouse. The results are the same: there is no significant association between spousal migration and any of the later-life health outcomes for those currently married or in a consensual union.

[36] I find nearly the same qualitative results using a lagged dependent variable model predicting depression in 2003, controlling for depression in 2001.

spousal migration and current marital status for many of my subsequent analyses, given the fact that stratified analyses severely limits my capacity to make comparisons across the stratified groups because of highly variant sample sizes. In some cases, including for a decomposition analysis of mediation effects, and in some analyses I use both a multivariable and a binary model of spousal migration history, stratified by current marital status. [37] I now turn to multivariable logistic regression models.

5.4 Multivariable logistic regression models

In Tables 5.6-5.8, I present multivariable logistic regression models for each of the three health outcomes. Given the varying results in the models based on whether or not I used the binary or the four-category measure of spousal migration, I run versions of the multivariable models using each version. Overall, I find some reduction in the effect sizes and significance levels of the measure of spousal migration to the U.S. across models. According to my theoretical model, this does not imply that spousal migration, and spousal migration for those not currently in a union specifically, is no longer important. It may be that the relationship between spousal migration history and later-life health outcomes is indirect, and mediated by factors like raising children alone or work history. I examine this mediation effect in more detail further on in the chapter, but now turn to examine the results of the multivariable models for each of the health outcomes.

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[37] I also tested simple and multivariable models that consider a four-category measure of spousal migration by whether or not respondents live alone, rather than respondent marital status. It is not possible to simply including living arrangements as a control measure in a multivariable model, since no respondents who are current married live alone, which would leave cells for married respondents with zero observations. I decide not to include these models here because cell sizes run quite small in some cases (n=86 of non-married respondents reported both spousal migration and living alone), and results are therefore too tenuous to interpret with confidence.

Depression

It is clear that current marital status is a more important predictor of depression than spousal migration history in the multivariable model, as was evident in the simple models. The binary measure of spousal migration is not significantly associated with depressive symptoms.[38] What is interesting to note is that there are other variables related to migration that are significantly associated with the odds of depression. Living in a state with high rates of out-migration to the US is significantly associated with greater odds of past-week depression, all else equal (OR: 1.38, 95% CI: 1.22, 1.56). Personal migration, which in the case of women is primarily internal migration within Mexico, is associated with 12% greater odds of depression controlling for spousal migration and residence in a high out-migration state ($p<0.05$). Finally, raising children alone is significantly associated with greater odds of depression, all else equal (OR: 1.47, 95% CI: 1.29, 1.67). It should be noted that living in a high out migration state, internal migration, and raising children alone are all more prevalent among those who report both spousal migration to the U.S. and not currently in a union.

The non-significant results for the association between spousal migration and later-life depression are consistent across models that use a continuous measure of depression (Table 5.9). Given the non-significant results using the binary measure of spousal migration even before controlling for other covariates, here I use only the four-category measure. When controlling for demographics only, spousal migration to the U.S. *and* being divorced, separated, or widowed is associated with increased depressive symptoms (B:0.62, $p<0.001$) but so is being divorced, separated, or widowed *without* spousal migration to the U.S. (B:0.48, $p<0.001$), when compared

[38] I also tested the multivariable models using the binary measure of spousal migration, stratified by current marital status (in a union versus not), and found that spousal migration was not significantly associated with depression in these models, confirming the finding that marital status appears to be driving the association between the four-category measure and depression.

to the reference group of women in a union with no U.S. spousal migration. This underscores the idea that current marital status is a more important predictor of past-week depressive symptoms. In the subsequent models I show the reduction of the coefficients, particularly for the indicator of having a US migrant spouse for those women not currently in a union. I address this change in coefficients across models further in my analyses of mediation effects below.

Hypertension

Spousal migration is not significantly associated with later-life hypertension after including the full set of controls, including family demographics, early childhood and adult socio-economic status when using the four-category measure of spousal migration and current marital status (Table 5.6). However, in the stratified models, spousal migration to the U.S. is associated with increased odds of hypertension when limited to the sample of respondents not currently in a union (Table 5.10, OR: 1.41, $p<0.01$). In addition to separating models by four-category and binary models, I present results in Tables 5.10 and 5.11 that further stratify the results by specific categories of divorce/separated versus widowed.[39] There is a significant association between spousal migration and the odds of hypertension for those who are currently widowed only (OR: 1.42, $p<0.01$). However, it should be noted that these stratified models are comparing results for models with quite different sample sizes, which could explain some of the differences in significance level.

Among the other set of controls in the model, older age, greater numbers of reported live births, and reporting a serious health condition during childhood are each associated with greater odds of hypertension. Raising children alone is associated with 22% greater odds of doctor-diagnosed hypertension ($p<0.01$); raising children alone is more prevalent among those currently not in a union, but in particular for those who both report spousal migration to the US and not currently being in a union. Poorer self-rated economic situation, a subjective measure, is associated with significantly greater odds of reporting hypertension, but having more household items, a slightly more objective measure of material conditions, is also significantly associated with greater odds of hypertension. This is a somewhat contradictory finding that might reflect the strain of relative or perceived economic deprivation, even while there may be a reverse socio-gradient for some health outcomes for this group of older adults in Mexico, where better economic conditions facilitate diets or sedentary lifestyles that are risk factors for chronic disease outcomes.

Diabetes

The results for the doctor-diagnosed diabetes outcome suggest that spousal migration among those who report not currently being in a union continues to be associated with greater odds of diabetes as was found in the simple models. Table 5.6 shows that reporting both spousal migration and being currently widowed, divorced, or separated is associated with 46% greater odds of reporting doctor-diagnosed diabetes, all else equal ($p<0.05$), compared with the reference group of women currently married and with no spousal migration history. There was a significant odds of diabetes for those who reported spousal migration to the U.S. in stratified models as well, including those who were separated or divorced, and those widowed at the time of the survey.

Unlike with the models for depression, living in a state with high rates of out-migration to the U.S. and respondents' personal migration each appeared to be significantly associated with *lower* odds of diabetes diagnoses, all else equal. Also unlike both the models for depression and hypertension, raising children alone is not significantly associated with diabetes (and is not associated with diabetes even in an analysis without controls, not shown). This may suggest that the pathways linking spousal migration and being currently widowed or divorced/separated from one's spouse to later-life diabetes do not operate through the stress of raising children alone, which again is most prevalent among those with both spousal migration and currently not married or in a union.

5.5 Mediation Analyses

My theoretical model emphasizes the possibility that the relationship between spousal migration to the U.S. and later-life health outcomes is mediated by the effect of raising children alone. I started to address this question across nested models for the continuous measure of depressive symptoms (Table 5.9), in which I added an indicator of whether or not respondents raised children alone to my model to assess changes in coefficients for the four-category measure of spousal migration to the U.S. and current marital status.

It is compelling to note that when I add the indicator for raising children alone, the size and significance level of the coefficient for those with spousal migration to the U.S. and currently not in a union reduced dramatically (a 41% reduction from $B=0.62$, $p<0.001$ to $B=0.36$, $p<0.05$), while there was less change in the coefficient for those currently not in a union but with no spousal migration to the U.S. This suggests that raising children alone partially mediates the relationship between spousal migration and later-life depressive symptoms for those currently not in a union. Or conversely, raising children alone mediates the effect of a dissolved union on later-life depressive symptoms, but only for those whose spouses migrated to the U.S. This indicator for spousal migration to the U.S./not in a union was reduced even further and no longer significant when I added measures of parent/sibling family and adult child migration to the U.S. This suggests that the involvement in expanded family U.S. migration networks might explain part of the relationship between spousal migration to the U.S. and increased later-life depressive symptoms for this sample of middle-aged and older women in Mexico.

The test for mediation effects in the case of logistic regression calls for an alternative approach to the comparison of reduced and full models with and without the key mediating variable to assess the impact on the coefficient and significance of the measure of spousal migration to the U.S. The –khb—function in STATA allows for the decomposition of mediation effects that account for the rescaling of variance in a latent outcome variable that occurs each time another predictor variable is added to a logistic regression model.

The limitation of the –khb- function is that it does not yet allow for key independent variables that are not either continuous or binary, which means that I cannot use my four-category measure of spousal migration by marital status. The alternative is to use the binary measure indicating whether or not respondents' spouses ever went to live or work in the U.S. or not. This complicates the test of raising children alone as a potential mediator, since my demographic variables suggest that a *combination* of spousal migration history and the end of one's marriage or union are correlated with raising children alone. Women whose spouses migrated but are currently still in a union and living with them are just as likely to report raising children alone as those currently married women whose spouses never migrated. In addition, there is no significant zero-order association between spousal migration and any of the three outcomes for those currently in a union. I therefore run the mediation models using the binary measure of spousal migration, restricted to those not currently in a union.

The results suggest that there is a very small and non-significant mediating effect of raising children alone on the relationship between spousal migration and each of the three later-life health outcomes. As shown in Table 5.12, the estimated odds ratios and significance levels decrease only very slightly when adding the measure of raising children alone (the full model) to the reduced model that includes only the measure of spousal migration to the US with the remaining demographic and socio-economic controls, as described in the multivariable models above.

Given the null results for the mediating effect of raising children alone, I moved on to test measures of adult socio-economic status as potential mediators of the relationship between spousal migration and greater odds of depression, hypertension, and diabetes, at least among those not currently in a union. I do not show the results here, given that I find no significant mediating effects when using any of the adult socio-economic status variables I've specified in my full multivariable model. These include type of work (domestic versus other) and other indicators of work history (ever worked, ever worked for pay, ever worked for free), number of household items, and subjective economic conditions; I test indicators of monthly income and wealth as alternative indicators of current economic status as potential mediators. The results are null for all of these measures as significant mediators on their own. While many of these measures are significantly associated with health outcomes on their own, there is little variability in the distribution of occupational and other SES measures among women who are not currently in a union.

The final measure that might explain some of the relationship between spousal migration and hypertension and diabetes, at least for those not currently married, is body mass index – an important risk factor for both hypertension and diabetes. It is possible that those with improved socio-economic status due to U.S. migration (or spousal migration) to the U.S. have higher body mass index on average, given their greater ability to purchase prepared and processed food products or to afford more sedentary lifestyles. The descriptive findings (Table 5.2) for the differences in body mass index do not fully support the idea that this measure could mediate the relationship between spousal migration and later-life hypertension and diabetes in particular, given that there do not appear to be large differences in the relationship between migration and BMI. One of the biggest differences is actually in the percentage of each group who have missing data on BMI: nearly 40% of those currently married with a history of spousal migration to the U.S. having missing BMI data compared to 30% of those who are currently married but have no history of spousal migration. The percentages of missing data are similar, however, for those who are not currently married or in a union, regardless of spousal migration history to the U.S. (34%). Nevertheless, I formally test BMI as a mediator of the relationship between spousal migration and both hypertension and diabetes, also using the –khb- decomposition analysis function in STATA, and find no significant mediating effect of BMI on my zero-order relationship (not shown). [40]

5.6 A propensity score matching approach

Now that I have carried out multivariable logistic regression models for each of my outcome variables and assessed potential mediators of this relationship, I will address in part the

[40] As might be expected, being in higher categories of BMI was in most cases significantly associated with greater odds of diabetes and hypertension in the model with full demographic and socio-economic controls. The exception was for models predicting diabetes that were either limited to those currently married or models that included this group of currently married respondents. It is also notable that those with missing BMI had significantly greater odds of hypertension and in diabetes models restricted to those not currently married compared to the reference group of underweight/normal respondents. This suggests that those with missing data may in fact have higher BMI on average, but may be reporting that they do not know their weight or height out of social desirability bias (or lack of access to knowledge about weight or height), which may present a challenge in really assessing how BMI does not does not explain part of the relationship between spousal migration and chronic disease outcomes (not shown).

possibility that there is some selectivity bias present in my analysis. That is, there may be criteria that influence women's selection into marriages that may or may not include spousal migration to the US; these may be factors related to family or the broader community (e.g. norms around male migration), or to personal selection into marriages that might promise greater stability in terms of spouse's presence in the home (non-migration), or greater economic returns (labor migration). The possibility that women select into marriages with spouses that will and will not eventually migrate should not be interpreted to mean that women are actively involved in the decision to migrate. Kanaiaupuni's (1995) qualitative research on women in Mexican sending communities suggests that women may not have much decision-making power at all in the decision to migrate, and are often not aware of their spouses' actual plans to leave for the US at the time of marriage.

On the other hand, the literature suggests that even if women do not know definitively whether or not their spouses intend to migrate, potential male partners with some migration experience – who may also be more likely to migrate again to work or live in the U.S. – may be more attractive given their relatively higher socio-economic resources compared to their non-migrant counterparts with similar levels of education (Choi & Mare, 2012; Parrado, 2003). This kind of selection into marriage would only prove to be a problem if the same criteria that influenced selection into marriage also influenced health outcomes. It would make it difficult to tease apart the effects of pre-migration characteristics that lead to marriages with spousal migration and the effect of spousal migration itself on later life health.

I therefore carry out a propensity score matching approach in which I leverage variables that refer to pre-marriage characteristics such as respondents' educational attainment (no versus any), mother's educational attainment, an indicator of childhood illness, and another of respondents' material conditions during childhood (measured by the indicator of whether or not they have sanitation facilities in their household).[41]

The final variable that I include attempts to introduce some exogeneity into my model of the propensity to end up in marriages in which the spouse migrates to the U.S. This is a measure of the number of years that respondents were exposed to the Bracero era of expanded labor migration to the U.S. This mirrors approach of Wong, Palloni and Soldo (2007) who use introduce a similar measure in a propensity score approach to asses the role of male migration to the U.S and later-life wealth among MHAS respondents. I experiment with ages to start considering "exposure" to the Bracero period, and the possibility of selecting into marriages that include migration, and select 16 years of age, which is just below the younger ages reported for entering into marriage.

Table 5.13 shows the full set of measures I use to implement the propensity score matching approach, although here I show the model as a multivariable logistic regression of spousal migration on the set of predictors. Notably, age is inversely associated with the odds of reporting a spouse who has migrated to the US, but exposure to the Bracero period is positively associated the odds of spousal migration to the US. Specifically, each year of additional exposure to the Bracero era is associated with 7% greater odds of having a spouse that migrated to the US, controlling for the effect of age and childhood socio-economic status indicators ($p<0.001$). The other two indicators reflect early childhood socio-economic and material

[41] The average age of last marriage for women in the sample is 20 years old, with only a few reporting marriage before 17 years old. Those that reported more than one marriage (n=663) reported slighter earlier ages for this first marriage, with an average of 17 years old and about 20 total cases reporting marriages at ages 12-15 years old.

conditions, although with some contradictory findings. Those who report having no sanitation facilities in their household before age 10 are significantly more likely to report having a US migrant spouse, suggesting a link between socio-economic and material disadvantage and the odds of spousal migration. On the other hand, having low levels of education (i.e. no education compared to any education) is associated with reduced odds of reporting a US migrant spouse. The relationship between childhood socio-economic status and the US migration of spouses during one's union may reflect different childhood contexts if those raised in high out-migration states, for example, are also more likely to report lack of sanitation facilities (but higher levels of education) *and* spousal migration to the US. This is difficult to confirm because I do not know respondent's place of birth or where they were raised. Mother's education and childhood health are not significantly associated with spousal migration to the U.S. but still important to include as baseline indicators in the propensity model (Austin, 2011).

Tables 5.14 and 5.15 present results from a propensity score matching method using the variables I presented in Table 5.13 to assess the propensity of having a US migrant spouse.[42] The figures for the average treatment effects can be interpreted as the difference in the proportion of respondents who did not report spousal migration that would have doctor-diagnosed hypertension if their spouses did indeed migrate to the U.S. after being matched on what I am

[42] I use the –teffects— function in STATA 13, which takes a nearest neighbor matching approach with replacement. This approach should produce similar results compared to some of the alternative methods (e.g. kernel, interval) offered in earlier versions STATA, but with more accurate estimation. That is, the – teffects – command accounts for greater uncertainty in its estimates of standard errors, which results in more accurate estimates of significance. I also run a post-estimation test of overlap the propensity for spousal migration to the US with the idea that respondents who might not plausibly match to any other respondent based on the group of "selection" covariates (e.g. early childhood circumstances, exposure to Bracero era), be 'trimmed' from the analysis. However, I find that respondents with and without spousal migration to the U.S. overlap sufficiently so that I do not have to trim respondents from my analysis.

assuming are “pre-marriage” covariates related to childhood SES, health, and migration context (Austin, 2011). The results largely reflect the findings from the regression analyses. There is no significant effect of spousal migration to the U.S. on the proportion of respondents who report depression or diabetes across the whole sample of women with some marital history, when matched on indicators that might influence the propensity to have a U.S. migrant spouse (Table 5.14). It does appear that there is a significant treatment effect of spousal migration to the US on hypertension for this group of all women with some marital status. The results for the average treatment effects suggest that the proportion of hypertension for women who reported no spousal migration to the US would increase by 5% if their spouse had migrated to the U.S., once matched on early-life characteristics ($p<0.05$). However, this significant result was not robust to all specifications of the propensity score matching approach. For example, while results were significant when using a nearest neighbor matching approach with a single neighbor allowed, but not with three neighbors, which gives me less confidence in this significant result.

The results in Table 5.15 repeat the propensity score matching method but only for women who were no longer in a union by the time of the survey. The results confirm the findings from the regression analyses, that spousal migration to the U.S. is associated with significantly higher proportions of diabetes and hypertension, but not depression. Specifically, the average treatment effects suggest that the proportion of hypertension would be 8% higher for non-married respondents who reported no spousal migration if they did experience spousal migration to the U.S., accounting for early-life indicators ($p<0.05$). Similarly, the proportion of diabetes would be 8% higher for those non-married respondents who did not experience spousal migration to the U.S. if their spouses had migrated to the U.S. ($p<0.05$). The figures are similar for the average treatment effects on the treated. This means that the effect of spousal migration to the U.S. on hypertension and diabetes is roughly the same for female respondents no longer in a union whether or not they actually experienced spousal migration to the U.S. The significant treatment effects of spousal migration to the U.S. for women no longer in a union hold up to alternative specifications of the propensity score matching method, including additional neighbors for the nearest neighbor matching method.

5.7 Interactions between labor and decision-making

The final piece of my analysis of the effect of spousal migration on the later-life health of older Mexican women is to examine differences in outcomes by dimensions of labor and power. This means testing whether there is a different effect of spousal migration on later-life health by dimensions of women's work in and outside the home, as well as their ability to make decisions within their families and feel a sense of control over their lives.

In Tables 5.16-5.18, I show tests of interaction effects between spousal migration and lifetime work in a domestic occupation (compared to service, professional, factory, or agricultural occupations, or no work outside the home), for each of the three health outcomes.[43] The only significant interaction between spousal migration and domestic work is for the model predicting doctor-diagnosed diabetes, which suggests that the combination of spousal migration and domestic work as associated with significantly greater odds of doctor-diagnosed diabetes compared to those with both no spousal migration and no domestic work as their lifetime occupation, the reference group ($p<0.01$); those who reported spousal migration but did not

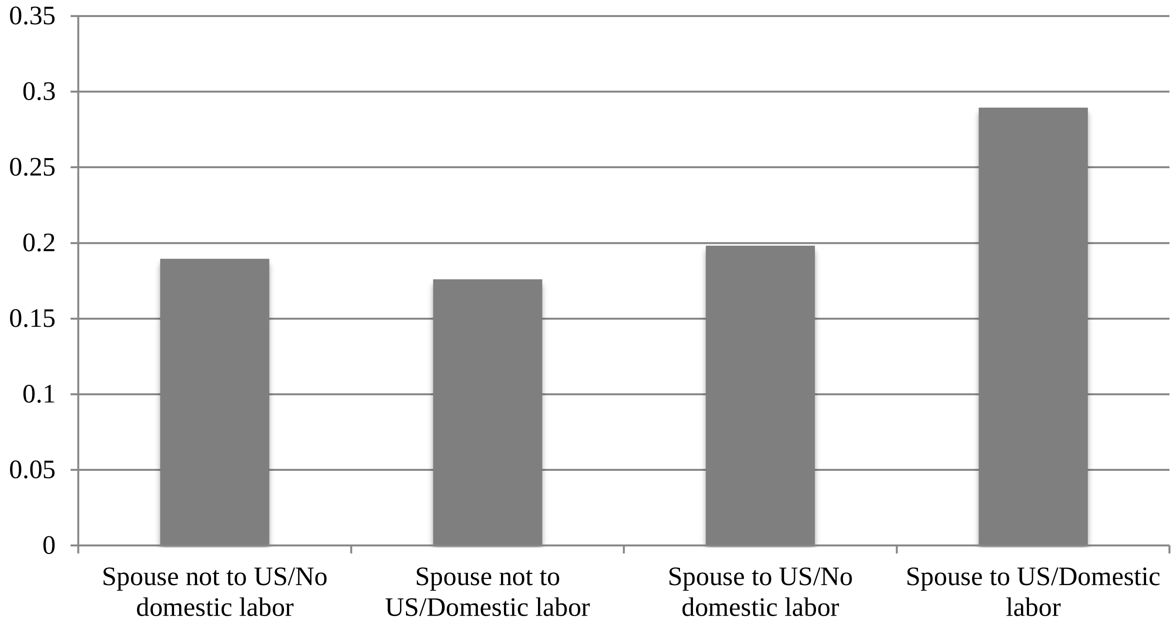
[43] I additionally test interaction terms between spousal migration and other dimensions of work history, including whether or not respondents worked at all, whether or not they worked for pay, or for free. I also consider the measures of raising children alone and the number of live births that respondents reported as potential indicators of the burden of work inside the home. There were no significant interaction effects between any of these measures and spousal migration for all three health outcomes.

report domestic work as their lifetime occupation did not have significantly greater odds of diabetes than the no spousal migration/no domestic labor group. Specifically, the odds of reporting doctor-diagnosed diabetes for those who report both spousal migration and domestic labor are 74% greater than the reference category of no spousal migration/no domestic labor, as derived from the following equation:

$$e^{\,0.51(\text{spousal migration}) - 0.09\ (\text{domestic}) + 0.59\ (\text{migration*domestic})} = e^{0.56} = 1.74$$

In Figure 5.1, I show the predicted marginal probabilities of doctor-diagnosed diabetes by categories of spousal migration and respondents’ history of domestic labor. The results here also suggest that the combined effect of spousal migration, in this case regardless of current marital status, and a history of domestic labor is associated with greater odds of doctor-diagnosed diabetes than only spousal migration or domestic labor, respectively.

Fig 5.1. Predicted marginal probabilities of doctor-diagnosed diabetes by spousal migration and respondents' history of domestic labor (n=5980)



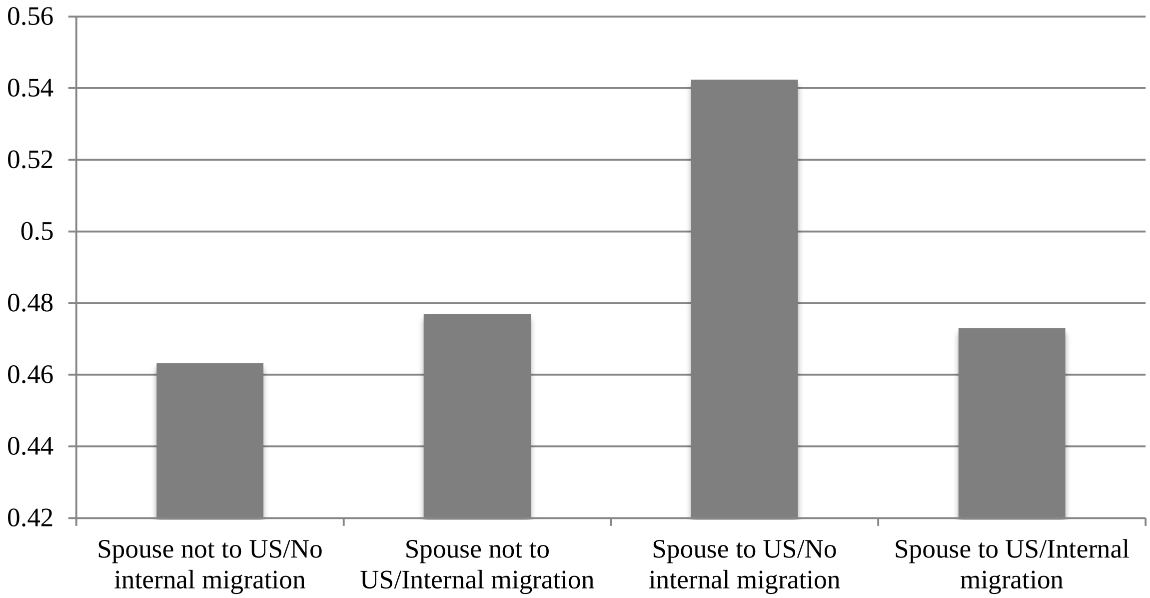
Source: Mexican Health and Aging Study, 2001 Note: Controlling for age, residence characteristics, current marital status, migration history, time married, number of live births, raising children alone, and childhood and adult SES

I next I tested interaction effects between spousal migration and respondents' own migration, which largely took place in Mexico. While the relative temporality of spousal and respondent migration is unknown, it is possible that women's own migration may influence health outcomes either by increasing an individual sense of mobility and control (perhaps a complicating factor to the idea of being 'left behind' if those left are still moving themselves), or by leading to increased burden of labor in and outside the home if women are migrating away from their families of origin, away from potential sources of support. The only significant interaction effect between spousal migration and respondent's personal migration is for the model of doctor-diagnosed hypertension. Those who report spousal migration and no personal migration had 37% greater odds of reporting hypertension compared to those with neither spousal nor personal migration histories (the reference category), all else equal, while the odds of reporting doctor-diagnosed hypertension were 4% greater for those who report both spousal and personal migration compared to their counterparts with no personal or spousal migration to report:

$$e^{0.31(\text{spousal migration}) + 0.05\,(\text{personal migration}) - 0.33\,(\text{spousal*personal})} = e^{0.04} = 1.04$$

These results are depicted in Figure 5.2, which shows that those who report spousal migration and a personal history of migration, primarily within Mexico, have lower odds of hypertension than those whose report spousal migration and no personal history of movement within Mexico. This suggests a slight buffering effect of women's experience of personal migration on the adverse influence of spousal migration on hypertension outcomes. This may complicate the idea of the effects of spousal migration on a uniform group of women who are 'left behind' in Mexico; many of these women are mobile themselves, either to the U.S. and back, or within Mexico, and this appears to an important consideration when examining the impact of spousal migration on long-term health outcomes.

Fig 5.2. Predicted marginal probabilities of doctor-diagnosed hypertension by spousal migration and respondents' own history of migration (n=5972)



Source: Mexican Health and Aging Study, 2001 Note: Controlling for age, residence characteristics, current marital status, time married, number of live births, raising children alone, and childhood and adult socio-economic characteristics.

The final set of interaction terms I test refer to the dimension of power as described by theories of gender and migration (Parrado & Flippen, 2005). Specifically, I test the interaction between spousal migration to the US and respondent's perceived power over family-level decision-making, and then a measure of perceived control over one's own life circumstances. The measure of power over family-level decision-making was asked only of respondents who are currently in a union, since the questions asked were about power over decision-making relative to these spouses (i.e. more, less, or the same power).[44] Again, the only significant interaction

[44] As suggested by Parrado and Flippen (2005), I also test interaction terms between spousal migration and age and education differences, respectively, between female respondents and their

effect between spousal migration and whether or not respondents have any ability to make decisions about their family affairs is for the outcome of hypertension. The results are as one might expect: there is no significant association between spousal migration and the odds of hypertension for who have equal or more decision-making power relative to their spouses. However, the odds of reporting doctor-diagnosed hypertension for those with both spousal migration to the US and less family-related decision-making power relative to their spouses are 34% higher than for those whose spouses never migrated and who have some say in family matters, all else equal, as derived from the following equation:

$$e^{-0.16 - 0.01 + 0.47} = e^{0.29} = 1.34$$

Figure 5.3 also shows the predicted probabilities of hypertension by categories of spousal migration and decision-making, confirming the finding that those who report both spousal migration and no decision-making power regarding family matters have higher odds of hypertension compared to those who report just one or the other. Again, this suggests that the

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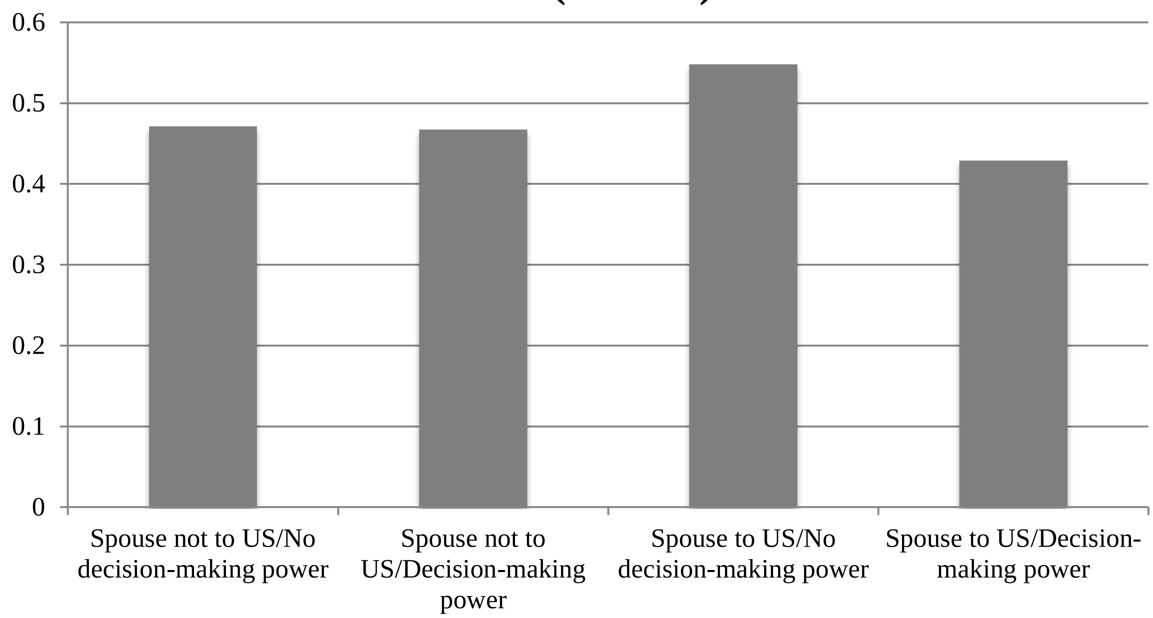
spouses, with the idea that differences in age and education may serve as a proxy for differences in female respondents' power within the relationship, with those closer in age and education levels more likely to have equal power within their relationships. This analysis is only possible for respondents who are currently married and whose spouses also responded to the MHAS survey; respondents were not asked about spouse's age and education directly, so I capture it from their corresponding spouse's interview and create a measure that subtracts husband's age or education from the female respondents' age or education. The average difference in age for those currently married is 4.6 years and the average difference in education is 0.37 years. There are no significant interaction effects between spousal migration and either difference in spouse's age or education levels on the effect of any of the three health outcomes for those currently in a union (not shown). There is a significant main effect of differences in education on the odds of depression only, with each year of difference in education associated with 4% greater odds of depression, controlling for the full set of demographic and socio-economic measures ($p<0.05$, not shown). I ran additional simple models to see if age and education differences between spouses predicted whether or not respondents felt they had power to make decisions within their relationships. Only the measure of educational differences was significantly associated with the odds of female respondents reporting they had no say in making family-level decisions ($p<0.05$).

combined effect of spousal migration and lack of decision-making power within families is associated with greater odds of hypertension for those currently married, even controlling for the full set of demographic and socio-economic characteristics.

Fig 5.3. Predicted marginal probabilities of doctor-diagnosed hypertension by spousal migration and respondent's ability to make family-related decisions (n=3702)



Source: Mexican Health and Aging Study, 2001 Note: Controlling for age, residence characteristics, current marital status, migration history, time married, number of live births, raising children alone, and childhood and adult socio-economic characteristi

I next tested interaction effects between spousal migration and the eight-item scale of mastery or personal control over life chances for all of the health outcomes. I found significant interaction effects between levels of mastery and spousal migration in their association with hypertension, only when restricting the analysis to respondents not currently in a union. There were no significant interaction effects for spousal migration and a personal sense of control over one's life for those currently married or the combined sample, either using the binary of spousal migration or the four-category measure of spousal migration and marriage. The results in Table 5.17 suggest that those who report both spousal migration and an average sense of mastery or personal control have 38% higher odds of reporting doctor-diagnosed hypertension compared with those who also have average levels of mastery and no spousal migration ($p<0.05$). For those who report spousal migration and (higher levels) of mastery, the odds of reporting hypertension are 71% greater as compared to the odds of hypertension for those who report no spousal migration and average levels of mastery.[45]

5.8 Additive Interaction Effects

I re-tested the interaction effects related to labor history, internal migration, and decision-making described using an additive interaction technique across different all three health outcomes. As shown in Tables 5.19 through 5.21, the results reflect in large part my findings using the multiplicative model. Specifically, the relative risk of doctor-diagnosed diabetes for those reporting both spousal migration and a history of domestic labor is 1.86 ($p<0.01$). This means that there is an additive risk of spousal migration to the US and domestic labor – a risk that is greater for those that experience both conditions than simply adding up the effects of spousal migration and domestic labor separately (or, the combined effect is larger than the sum of the individual effects) (Knol, van der Tweel, Grobbee, Numans, & Geerlings, 2007). On the other hand, only those who reported working in a domestic field *without* spousal migration to the U.S. were associated with higher risk of later-life depression (RR: 1.29, 95% CI: 1.11, 1.16).

[45] I additionally tested the same interaction effects in models predicting continuous measures of depression and found no significant results.

There also appear to be significant interaction effects between spousal migration to the U.S. and respondents' own migration history. Specifically, respondents who reported spousal migration to the US and were not migrants themselves were estimated to have greater relative risk of diabetes and hypertension later in life (RR: 1.45, 95% CI: 1.06, 1.98 for diabetes; RR: 1.41, 95% CI: 1.09, 1.83) compared to respondents with no spousal migration history and no internal migration, the reference group. However, those who reported spousal migration to the U.S. and that they also migrated, primarily within Mexico, were not estimated to have significantly different risk of hypertension or diabetes compared to the reference group. In contrast to the findings using the multiplicative interaction methods, there were no significant additive interactions between spousal migration to the US and married respondents' decision-making power relative to their spouses.

5.9 Other Family Member US Migration

As with the analysis for the male MHAS respondents, I also assess the potential confounding and/or moderating effects of the U.S. migration of other family members. For example, if respondents who report spousal migration to the U.S. are also more likely to have adult children in the U.S. or to have experienced the migration of other family members, then the effects of spousal migration on health might capture some of the effects of other family member migration. To test this, I examine alternate three-variable and multivariable models controlling for the effects of adult child and other family member migration to the U.S.

There may also be an interaction between the effects of other family member migration and spousal migration on later-life health for Mexican women. This interaction might happen in a number of ways. For one, the U.S. migration of other family members might exacerbate the adverse effect of spousal migration to the U.S. on later-life health if women who do not also migrate to the US experience separation from multiple family members. On the other hand, the U.S. migration of other family members might buffer the effect of spousal migration to the U.S. if it is considered to be a more normalized activity within the context of one's family, or if other family members are providing remittances that may ease some of the potential burden of work both in and outside the home that women 'left behind' might face when their spouses migrate to the U.S.

I found significant additive interactions between spousal migration to the U.S. and the U.S. migration of either parents or siblings and diabetes and depression only. Counter to the scenarios I proposed above, I found greater relative risk of depression for those who reported parent or sibling U.S. migration and no spousal migration to the U.S. compared to those with neither family nor spousal migration to the U.S., as shown in Table 5.22 (RR: 1.37, $p<0.001$). There were no estimated differences in the risk of depression for those with spousal migration to the U.S. regardless of having other family members in the U.S. (Table 5.22). On the other hand, there was a significant additive interaction between family member migration to the U.S. and spousal migration to the U.S. in predicting diabetes. Those who report both spousal and parental and/or sibling migration to the U.S. were estimated to have greater relative risk of later-life diabetes compared to those who reported neither spousal nor family migration to the US (Table 5.23). There were no significant multiplicative interaction terms between family migration to the U.S. and spousal migration to the U.S. across all three health outcomes. There are also no significant multivariable interaction terms between whether or not respondents' children migrated to the U.S. and spousal migration to the U.S.

5.10 Discussion

Overall, the results of this chapter suggest that the effect of spousal migration to the U.S. on the later-life health of middle-aged and older Mexican women is heavily dependent on respondents' current marital status. For women who are currently married or in a consensual union, there are largely non-significant effects of spousal migration to the U.S. on later-life health, with the exception of some significant interaction effects between spousal migration and factors like decision-making power within families.

On the other hand, for women who are not currently in a union – divorced, separated, or widowed – a history of spousal migration to the U.S. is associated with significantly greater odds of doctor-diagnosed diabetes and hypertension, respectively. This result appears to be robust to a multivariable model that includes a number of controls for current and past demographic and socio-economic characteristics. The finding of adverse effects of spousal migration on later-life diabetes and hypertension for those not currently in a union are also reflected in the results of the propensity score matching methods, where I attempt to address potential selection bias on characteristics of female respondents before marriage, including indicators of exposure to the Bracero Era period of increased labor migration to the U.S., and respondents own characteristics of early childhood education and material conditions. Even when 'matching' respondents who are similar on these criteria, the probability of diabetes and hypertension, respectively, is much higher for those whose spouses migrated to the U.S. to live or work. In addition, the results remain nearly identical when limiting the models to respondents who have had tests for hypertension and/or diabetes in the past two years (Appendix B). This iteration of the analysis, limited to those who have actually had recent tests for the chronic diseases in question is an important step, given the descriptive findings that women whose spouses migrated and are not currently in a union are the most likely to have had these clinical tests, which may inflate the likelihood of their reports of positive diagnoses.

The findings of adverse effects of spousal migration to the US on diabetes and hypertension outcomes later on in the life course, at least for those currently not in a union, reflects to some degree the qualitative research on the effect of spousal migration on women ‘left behind’ in Mexico. As Dinerman (1982) observed based on her ethnographic work on the effect of migration on Mexican families in the 1970s:

> “The increasingly prolonged absence of male heads of household has had a negative effect on family roles and relationships. It has caused notable strain between husbands and wives. Women comment freely on their suspicions of their absent husbands’ sexual activities and express fear that a husband will ‘take another wife’ in the United States.” (70)

In addition to concerns about the dissolution of unions, which appears to have a significant effect in its own right on later-life health, Dinerman also observed the burden that women faced in raising children on their own, stating that many women in the village she studied “commented on the difficulty of rearing adolescent sons without their husbands present to enforce discipline” (72). Although there is some ambiguity in my analysis as to the timing of raising children alone, and the gender, age, and numbers of children raised alone at any one time, my findings suggest that there are long-term effects of the experience of raising children alone, most notably on the odds of depression and hypertension.

There are some complicating factors even to this overall finding of adverse effects of spousal migration on later-life health. For one, my results suggest that spousal migration is not significantly associated with depression. In fact, current marital status appears to be a much stronger predictor of depression than spousal migration; those not currently in a union have significantly greater odds of depression, regardless of their spousal migration history. This finding runs counter to much of the qualitative research, as well as quantitative research carried out on small, community-level samples, which points to the adverse mental health impacts of being ‘left behind’ (Bojorquez et al., 2009; McGuire & Martin, 2007). For example, in a community-based survey of women in a rural Mexican town, Bojorquez and authors found that having a partner in the U.S. was associated with significantly greater odds of scoring above a cut-point for depression on the CES-D scale (OR: 3.8, 95% CI: 1.92, 7.43). Ullmann and authors also found a significant association between spousal migration to the U.S. and “emotional or psychological”, vaguely defined, for female respondents to the Mexican Migration Project. In a 2005 survey across multiple communities in Mexico, Familiar and co-authors (2011) found significantly increased odds of depression and anxiety for family members of U.S. migrants relative to respondents with neither personal or familiar U.S. migration experience, although they did not differentiate which family members were migrants (e.g. spouse versus child).

On the other hand, some of the extant research on the mental and emotional well-being of women in Mexico with U.S. migrant spouses corresponds to my findings of null effects for depressive symptoms. In forthcoming research, Nobles and authors find no significant association between depression and spousal migration to the U.S. for female respondents to the Mexican Family Life Survey, and interviewed while their spouses were in the U.S., although there were significant associations between spousal migration and other aspects of well-being, including reduced sleep and increased television-viewing as part of women’s leisure activities (Nobles, Rubalcava, & Teruel, 2014). These adverse effects on sleep and increases in more sedentary behavior might support the significant finings I observe between spousal migration to the U.S. and chronic diseases like hypertension and diabetes. In addition, although Salgado de

Snyder (1993) documents a great deal of stress due to taking on additional responsibilities, common feelings of loneliness and isolation, and “high” scores of psychological distress in her small, community-based sample of rural Mexican women with U.S. migrant spouses, she finds that the majority (60%) of women reported being happy with their husband’s decision to migrate given the possibility of increased income.

It may be that depression in this case reflects more immediate conditions of family life and change, as well as current socio-economic conditions. The measure of depression used in this analysis reflects only past-week symptoms, rather than chronic experiences with depression over the life-course. In this case, more recent life events like widowhood or marital dissolution, and the potential for reduced social and economic support in middle-age and older adulthood may be more important in shaping one’s current emotional and mental health than past events like spousal migration to the U.S. I know from my analyses in Chapter Four that men in the sample returned to Mexico on average 29 years before baseline, whereas marital dissolution was more recent, on average, for women. Women who were divorced or separated ended their marriages an average of 17 years before baseline; widowhood occurred an average of 15 years before baseline.

I attempted to address the question of family support to some degree with an additional analysis of spousal migration and whether or not respondents live alone, although too few respondents live alone to fully execute this analysis. I additionally attempted an analysis modeling whether or not respondents reported five or more past-week depressive symptoms at baseline and at a two-year follow-up interview in 2003, with different iterations of the measure of spousal migration by marital status (the four-category measure vs. a binary measure with models stratified by current marital status, not shown). The results reflect the cross-sectional models, with no significant association between spousal migration to the US and reporting depression at two time periods in later-life.

In addition to null findings for the effect of spousal migration on depression, there were varying results for the diabetes and hypertension outcomes when further stratifying by respondent marital status. While spousal migration to the U.S. is associated with significantly greater odds of doctor diagnosed diabetes for both those who are currently widowed and those reporting they are divorced or separated, respectively, the effect of spousal migration to the U.S. on hypertension is only significant for women reporting they are currently widowed. This suggests that the effects depend on current marital status even within the category of those respondents not currently in a union – not surprising, given the distinct experiences of marital dissolution versus widowhood. It is surprising that the effects of spousal migration are more consistently significant for women who are widowed, although the difference in effects may be due to different sample sizes across the stratified models.

There are also varying results for the models of diabetes and hypertension when testing a number of interaction terms related to female respondents' labor history, personal migration history, and decision-making assessments. There was a significant interaction in the effect of spousal migration and domestic labor on the odds of doctor-diagnosed diabetes, but not for the other health outcomes. In particularly, reporting both spousal migration and domestic labor is significantly associated with greater odds of doctor-diagnosed diabetes, in this case for all female respondents with some history of marriage or consensual union (i.e. both currently in a union and not). This result held when testing the method of additive interaction effects, where the relative risk of doctor-diagnosed diabetes is significantly greater for those reporting both spousal migration to the U.S. and a history of domestic work compared to those who reported neither experience.

The relationship between male migration and women's work, particularly in informal sectors, is also reflected in ethnographic work on Mexican migration. As Dinerman (1978) notes based on her work on Mexican migration in the 1970s, "the removal of a potential source of cash inflow, at least temporarily, combined with the expenditure of cash to sponsor immigration, must be compensated. A major compensatory mechanism for many households is the market vending by an adult woman of the household. Such women are not always experienced vendors…" (499). This means that in some cases, paid work may be the result of spousal migration, particularly as male migrants are settling into work in the U.S., and also to compensate for the uncertainty of their remittance-sending (King, 2007). That said, paid work, including domestic labor, appears to be more common among women who are not currently in a union, regardless of spousal migration history.

As predicted by my conceptual model drawing on theories of gender and power in migration research, there are also significant interactions between spousal migration and decision-making power. For those currently in a union – those who responded to questions about decision-making power relative to their spouses – there is a significant interaction in the effect of spousal migration and decision-making power on the odds of later-life hypertension. Even though there are no main effects of spousal migration on any health outcome for those currently married, those who report both spousal migration and less decision-making power relative to their spouse have significantly greater odds of doctor-diagnosed hypertension compared with the reference group of respondents who report both no spousal migration and more or equal decision-making power than their husbands when it comes to family affairs.

One of the key concerns in interpreting the results of this chapter, and the results of the interaction terms in particular, is the ambiguous timing of events under analysis. For example, while there appears to be a significant interaction in the effect of spousal migration and family decision-making power on the odds of diabetes for those respondents currently in a union (with greater odds of diabetes for those reporting both spousal migration and low family decision-making power), the measure family decision-making power reflects *current* circumstances. It does not necessarily mean that women with higher or equal levels of family decision-making power relative to their spouses *during the study* had any say in whether or not their spouse migrated to the US, or other details of family life, earlier in their life. As Kaniaiapuni (1995) found in her more recent study of women's role in the process of migration in two Mexican villages, women often had very little say in whether or not their spouses were going to migrate, and decisions were often made within a few days of departure. Hondagneu-Sotelo (1994) reports similar findings of women's limited decision-making around migration itself, based on her interviews with Mexican men and women in the US, reflecting on their and their spouses' departure from Mexico.

For any number of reasons, including both respondents' and male spouses' physical or cognitive functioning, female respondents' relative power over family-level decisions may have improved or eroded over time. Spousal migration itself may have shifted decision-making patterns within families, as Hondagneu-Sotelo also reports that the Mexican immigrant women she interviews suggest that their husbands' absence due to US migration required them to "act decisively and autonomously" as de facto heads of household (p. 65). Similar ambiguities about time might be applied to the interaction terms considering spousal migration and respondents personal migration, since the relative timing of each is unknown.

Another limitation of this analysis is that the variables of migration and marriage are measured at the individual level. I do not have information on community-level experiences of migration and sex ratios during respondents' earlier lives. While I know some information about their current residence (high out-migration state or not, urban residence or not), I have no way of assessing whether this is the same context in which they lived out their marital and migration histories earlier in life. Choi and Mare (2012) emphasize the importance of considering community-level migration in models combining marriage and migration, given the fact that migration can contribute to vast changes in community marriage markets by removing marriageable single men for stretches of time. They suggest that women in these depleted marriage markets may be more likely to 'marry down' to men with lower education levels. It's possible that partnering with men with lower education might lead to poorer economic outcomes for the family unit across the life-course, especially compared to women with a wider selection of marriage prospects in lower out-migration communities. On the other hand, women who have higher levels of education may also enjoy higher levels of power over decisions within their families and about their personal lives, which may diminish the adverse effects of spousal migration on health outcomes (Parrado et al., 2005). Raphael (2013) also finds that the intensity of out-migration in a given community is positively associated with women's educational attainment and entry into the labor market before marriage, which might also afford them more decision-making power once married. I am not able to take this community-level variation into account in my models.

Despite the limitations in my analysis, the overall findings support my hypothesis that spousal migration has an adverse effect on the later-life health of Mexican women, with the qualifications that these results only apply to those not currently in a union, and to models of doctor-diagnosed diabetes and hypertension. Even with these restrictions, the results speak to the importance of family migration history in shaping later-life chronic disease outcomes for older women in Mexico, in combination with their marital histories. Although the timing of spousal migration is not entirely clear, these findings point to the potentially 'long-arm' of spousal migration to the U.S. on the health of a subset of Mexican women who are currently divorced, separated, or widowed, suggesting that spousal migration history may be an important aspect of life-course influences on later-life health.

5.11 Tables

Table 5.1. Baseline descriptive statistics for older Mexican women in Mexico, based on spousal migration history to the US. (n=6764)

	Spouse never migrated to US, currently married (n=3211)	Spouse never migrated to US, currently widowed/divorced/separated (n=2079)	Spouse migrated to the US, spouse-respondent (n=627)	Spouse migrated to US, no spouse-respondent (n=336)
Age, mean	59.3 (7.85)	65.5 (10.3)	61.1 (7.9)	66.0 (9.7)
				p<0.001
Urban residence	2123 (65.9)	1521 (73.1)	342 (54.6)	241 (71.7)
				χ^2=83.5, p<0.001
High out-migration state	824 (25.6)	489 (23.5)	305 (48.6)	130 (38.7)
				χ^2=182.8, p<0.001
Marital History				
Current marital status				
Married	3211 (100.0)	--	627 (100)	1 (0.3)
Widowed	0 (0.00)	--	0	97 (28.9)
Divorced/Separated	0 (0.00)	--	0	238 (70.8)
Never married	0 (0.00)	--	0	0
Married more than once	313 (9.8)	241 (11.6)	52 (8.3)	52 (15.5)
				χ^2=16.3, p<0.01
Total years married	37.8 (9.77)	29.5 (14.6)	39.7 (10.2)	29.8 (14.3)
				p<0.001
Occupational History				
Ever worked	2006 (62.5)	1568 (75.5)	352 (56.1)	255 (75.9)
				χ^2=144.2, p<0.001
Ever worked for pay	1855 (57.8)	1499 (72.2)	310 (49.4)	242 (72.0)
				χ^2=172.3, p<0.001
Ever worked for free	599 (18.9)	451 (22.0)	138 (22.0)	80 (23.8)
				χ^2=11.8, p<0.01
Primary occupation				
Domestic	490 (15.3)	445 (21.5)	81 (12.9)	84 (25.0)
Factory	202 (6.3)	119 (5.8)	24 (3.8)	26 (7.7)
Service	626 (19.5)	528 (25.5)	116 (18.5)	84 (25.0)
Agricultural	200 (6.24)	143 (6.9)	71 (11.3)	25 (7.4)
Professional	481 (15.0)	328 (15.8)	58 (9.3)	35 (10.4)
Never worked	1205 (37.6)	507 (24.5)	275 (43.9)	80 (23.8)
				χ^2=214.2 p<0.001
Family demographics				
Number of live births, mean (SD)	6.14 (3.46)	6.13 (3.60)	7.11 (3.73)	6.92 (3.53)
				p<0.001
Ever raised children alone	424 (13.2)	852 (40.9)	213 (34.1)	221 (65.8)
				χ^2=781.1 p<0.001
Low family decision-making power	685 (21.3)	--	148 (23.6)	--
				χ^2=1.6 p=0.21
Mastery (range: 0-8 points),	3.84 (1.11)	3.78 (1.12)	3.75 (1.11)	3.78 (1.06)

mean (SD)				
				p<0.05
Personal Migration History				
Ever migrated internally	1962 (61.2)	1302 (62.8)	427 (68.1)	190 (56.6)
Ever migrated to U.S.	42 (1.3)	64 (3.1)	57 (9.1)	43 (12.8)
Never migrated	1242 (38.8)	773 (37.3)	196 (31.3)	103 (30.7)
				χ^2=17.9 p<0.001
Family Migration to U.S.				
Siblings or parents migrated to U.S.	790 (24.6)	412 (19.8)	287 (45.8)	145 (43.2)
				χ^2=217.1 p<0.001
Adult child currently lives or works in U.S.	655 (20.4)	378 (18.2)	301 (48.0)	147 (43.8)
				χ^2=334.1 p<0.001
Early-life SES and health				
Before age 10:				
No household sanitation	2062 (64.2)	1352 (65.1)	466 (74.4)	244 (72.6)
				χ^2=31.4 p<0.001
Serious health problem	344 (10.7)	230 (11.1)	75 (11.9)	39 (11.6)
				χ^2=0.98 p=0.81
Often went to bed hungry	862 (30.6)	542 (30.9)	169 (31.2)	99 (34.5)
				χ^2=1.93 p=0.59
No education	835 (25.9)	670 (32.2)	148 (23.6)	91 (27.1)
				χ^2=31.3 p<0.001
Mother had no formal education	1660 (51.8)	1130 (54.5)	301 (48.0)	172 (51.3)
Don't know mother's education	250 (7.8)	202 (9.7)	69 (11.0)	45 (13.4)
				χ^2=29.2 p<0.001
Father worked in agricultural, domestic, no work	1566 (55.7)	961 (55.0)	368 (68.0)	178 (62.0)
Construction	375 (13.4)	240 (13.7)	52 (9.6)	30 (10.5)
Garden	266 (9.5)	169 (9.7)	34 (6.3)	21 (7.3)
Restaurant	229 (8.2)	107 (6.1)	35 (6.5)	26 (9.1)
Office or other	210 (7.5)	160 (9.2)	29 (5.4)	21 (7.3)
Don't know or no parents	164 (5.8)	112 (6.4)	23 (4.3)	11 (3.8)
				χ^2=65.3 p<0.001
Adult SES				
Number of items in household, mean (SD)	4.37 (1.74)	4.08 (1.79)	4.66 (1.42)	4.38 (1.65)
				p=0.66
Poor self-rated economic conditions	2516 (78.4)	1692 (81.4)	511 (81.5)	273 (81.3)
				χ^2=8.96 p<0.05
Bottom half of monthly income	1369 (57.4)	1092 (52.5)	363 (57.9)	167 (49.7)
				χ^2=17.97 p<0.001
Bottom half of net assets	1309 (40.8)	1194 (57.4)	247 (39.4)	195 (58.0)
				χ^2=171.84 p<0.001
Source: Mexican Health and Aging Study, 2001 and 2003.				

Table 5.2. Descriptive health statistics for older Mexican women in Mexico, based on spousal migration history to the U.S. (n=6764)				
	Spouse never migrated to US, currently married (n=3211)	Spouse never migrated to US, currently widowed/divorced/separated (n=2079)	Spouse migrated to the US, currently married (n=627)	Spouse migrated to US, no spouse-respondent (n=336)
Diagnosed with hypertension	1424 (44.4)	945 (45.5)	300 (47.9)	190 (56.6)
				χ^2=30.3, p<0.001
Had test for hypertension in past two years	2505 (78.0)	1653 (79.5)	511 (81.5)	280 (83.3)
				χ^2=14.9, p=0.06
Diagnosed with diabetes	565 (17.6)	347 (16.7)	113 (18.0)	84 (25.0)
				χ^2=29.5, p<0.001
Had test for diabetes in past two years	2276 (70.9)	1474 (70.9)	457 (72.9)	252 (75.0)
				χ^2=15.4, p=0.05
Past-week depressive symptoms, 2001				
Depressed ($\geq$ 5 symptoms)	1242 (39.8)	984 (48.6)	253 (41.4)	179 (54.9)
				χ^2=53.3, p<0.001
Mean (SD)	3.82 (2.70)	4.37 (2.74)	3.99 (2.72)	4.61 (2.80)
Other health measures				
Body Mass Index				
Underweight/Normal (24.9 or below)	643 (20.0)	474 (22.8)	102 (16.3)	73 (21.7)
Overweight (25-29.9)	909 (28.3)	554 (26.7)	156 (24.9)	81 (24.1)
Obese (29.9 or above)	685 (21.3)	348 (16.7)	123 (19.6)	67 (19.9)
Missing	974 (30.3)	703 (33.8)	246 (39.2)	115 (34.2)
				χ^2=60.8, p<0.001
Insurance coverage, 2001	2066 (64.3)	1343 (64.6)	357 (56.9)	225 (66.9)
				χ^2=23.2, p<0.01
Usual source of medical care, 2001	1001 (31.2)	617 (29.7)	201 (32.1)	97 (28.9)
				χ^2=3.66, p=0.89
Source: Mexican Health and Aging Study, 2001 and 2003.				

Table 5.3. Simple logistic regression models of depression, hypertension and diabetes for older Mexican women by spousal migration history (n=6266 women with some marital history, non-missing on spousal migration variables)

	Five or more depressive symptoms (n=6253)			Doctor-diagnosed hypertension (n=6126)			Doctor Diagnosed Diabetes (n=6135)		
	OR		95% CI	OR		95% CI	OR		95% CI
Spousal Migration History/Marital Status (Ref = No Spousal Migration/Currently Married)									
No spousal migration to U.S., Currently Widowed, Divorced, or Separated	1.42	***	(1.27, 1.59)	1.05		(0.94, 1.18)	0.94		(0.81, 1.09)
Spouse migrated to US, Currently Married	1.07		(0.90, 1.27)	1.15		(0.97, 1.37)	1.02		(0.82, 1.28)
Spouse migrated to US, Currently Widowed, Divorced, or Separated	1.76	***	(1.41, 2.21)	1.60	***	(1.28, 2.01)	1.53	**	(1.18, 1.99)

Source: Mexican Health and Aging Study, 2001, *p<0.05, **p<0.01, ***p<0.001

Table 5.4. Simple logistic regression models of depression, hypertension and diabetes for older Mexican women by spousal migration history and current marital status (n=6266 women with some marital history, non-missing on spousal migration variables)

	Five or more depressive symptoms (n=6084)						Doctor-diagnosed hypertension (n=6245)						Doctor-diagnosed Diabetes (n=6254)					
	Currently in union			Currently widowed, divorced, separated			Currently in union			Currently widowed, divorced, separated			Currently in union			Currently widowed, divorced, separated		
	OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI
Spouse Migrated to the US	1.08		(0.90, 1.28)	1.28	*	(1.01, 1.62)	1.13		(0.95, 1.35)	1.45	**	(1.14, 1.83)	0.97		(0.78, 1.22)	1.53	**	(1.16, 2.01)

Source: Mexican Health and Aging Study, 2001, *p<0.05, **p<0.01, ***p<0.001

Table 5.5. Simple linear regression of depression for older Mexican women by spousal migration history, four-category measure									
	Four-category measure (n=6218)			Binary Measure - Currently Married (n=3897)			Binary Measure - Not Currently Married (n=2518)		
	B		SE	B		SE	B		SE
Spouse Migration to the US[a]									
No spousal migration, not currently in union	0.55	***	(0.08)						
Spousal migration, currently in union	0.21		(0.12)						
Spousal migration, not currently in union	0.77	***	(0.16)						
Spouse Migrated to the US[b]				0.21	***	(0.12)	0.22	***	(0.16)
Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.001. Notes: A. Ref = No Spousal Migration to the US/Not Currently Married, B. Ref = No Spousal Migration to the US									

Table 5.6. Multivariable model of past-week depression, hypertension and diabetes for older Mexican women by spousal migration history, four-category measure

	Depression (n=5989)			Hypertension (n=5877)			Diabetes (n=5885)		
	OR		95% CI	OR		95% CI	OR		95% CI
Spouse Migration to the US									
No spousal migration, not currently in union	1.25	**	(1.08, 1.45)	0.95		(0.82, 1.10)	0.89		(0.73, 1.07)
Spousal migration, currently in union	0.87		(0.72, 1.05)	0.99		(0.83, 1.20)	1.03		(0.81, 1.30)
Spousal migration, not currently in union	1.43	**	(1.09, 1.86)	1.24		(0.96, 1.61)	1.46	*	(1.08, 1.98)
Age	1.01	*	(1.00, 1.02)	1.01	***	(1.01, 1.03)	1.01		(0.99, 1.02)
Urban residence	0.94		(0.83, 1.07)	0.99		(0.88, 1.13)	1.24	*	(1.05, 1.46)
High out-migration state	1.38	***	(1.22, 1.56)	1.02		(0.91, 1.16)	0.70	***	(0.60, 0.83)
Respondent was a migrant (primarily internal)	1.12	*	(1.00, 1.26)	1.04		(0.93, 1.16)	0.91		(0.79, 1.05)
Family Demographics									
Number of live births	1.01		(0.99, 1.03)	1.02	*	(1.00, 1.04)	1.05	***	(1.03, 1.08)
Raised children alone	1.47	***	(1.29, 1.67)	1.22	**	(1.07, 1.39)	1.01		(0.86, 1.19)
Number of years married	1.01	*	(1.00, 1.01)	1.00		(0.99, 1.01)	0.99		(0.99, 1.01)
Early Childhood (possible selection criteria)									
No education	1.13		(0.99, 1.29)	0.92		(0.80, 1.05)	1.13		(0.95, 1.33)
No sanitation in household before age 10	1.20	**	(1.06, 1.37)	1.08		(0.95, 1.22)	1.01		(0.86, 1.18)
Serious health condition before age 10	1.61	***	(1.36, 1.91)	1.24	*	(1.05, 1.46)	1.35	**	(1.11, 1.65)
Adult Socio-economic Status									
Domestic work	1.24	**	(1.07, 1.42)	1.09		(0.95, 1.26)	1.04		(0.87, 1.24)
Number of household items	0.92	***	(0.89, 0.96)	1.04	*	(1.00, 1.08)	1.06	*	(1.01, 1.11)
Poor self-rated economic situation	2.34	***	(2.02, 2.72)	1.25	**	(1.09, 1.43)	1.47	***	(1.22, 1.77)
Body Mass Index (ref = normal/underweight)									
Overweight				1.24	**	(1.07, 1.45)	1.02		(0.84, 1.25)
Obese				2.15	***	(1.82, 2.54)	1.17		(0.92, 1.45)
Don't Know/Refused				1.34	***	(1.15, 1.56)	1.12		(0.92, 1.36)
LR Chi-squared	**501.1**	***		**196.1**	***		**101.9**	***	

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.001

Table 5.7. Multivariable model of past-week depression, hypertension and diabetes for older Mexican women by spousal migration history, for women currently in union										
		Depression (n=3743)			Hypertension (n=3670)			Diabetes (n=3676)		
		OR		95% CI	OR		95% CI	OR		95% CI
Spouse Migration to the US		0.87		(0.71, 1.05)	0.95		(0.79, 1.15)	1.00		(0.78, 1.28)

Source: Mexican Health and Aging Study, 2001 and 2003, *p<0.05, **p<0.01, ***p<0.001. Notes: Controlling for age, residence characteristics, personal migration history, family demographics (marital status, total number of years married, number of live births, whether or not raised children alone), childhood and adult SES characteristics, and BMI category at the time of the survey.

Table 5.8. Multivariable model of past-week depression, hypertension and diabetes for older Mexican women by spousal migration history, for women currently widowed, divorced, or separated.										
		Depression (n=2246)			Hypertension (n=2207)			Diabetes (n=2209)		
		OR		95% CI	OR		95% CI	OR		95% CI
Spouse Migration to the US		1.16		(0.90, 1.50)	1.41	**	(1.10, 1.81)	1.73	***	(1.29, 2.32)

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00. Notes: Controlling for age, residence characteristics, personal migration history, family demographics (marital status, total number of years married, number of live births, whether or not raised children alone), childhood and adult SES characteristics, and BMI category at the time of the survey..

Table 5.9. Multivariable logistic regression models of depression for Mexican women by spousal migration history (n=5964)

	(Model 1)[a] Add Demographics			(Model 2) Add Raising Children Alone			(Model 3) Add Childhood and Adult SES			(Model 4) Add adult child and other family member migration		
	OR		SE	OR		SE	OR		SE			SE
Spousal Migration History/Marital Status (Ref = No Spousal Migration/Currently Married)												
No spousal migration to U.S., Currently Widowed, Divorced, or Separated	0.48	***	(0.10)	0.37	***	(0.10)	0.33	**	(0.10)	0.34	***	(0.10)
Spouse migrated to US, Currently Married	-0.02		(0.12)	-0.16		(0.12)	-0.09		(0.12)	-0.10		(0.12)
Spouse migrated to US, Currently Widowed, Divorced, or Separated	0.62	***	(0.17)	0.36	*	(0.18)	0.35	*	(0.17)	0.26		(0.17)

Source: Mexican Health and Aging Study, 2001, *p<0.05, **p<0.01, ***p<0.001. A. Controlling for age, residence characteristics, respondents' own migration history, total time married, and number of live births.

Table 5.10. Multivariable model of past-week depression, hypertension and diabetes for older Mexican women by spousal migration history, binary measure, women currently widowed only

	Depression			Hypertension			Diabetes		
	(n=1578)			(n=1553)			(n=1556)		
	OR		95% CI	OR		95% CI	OR		95% CI
Spouse Migration to the US	1.20		(0.88, 1.62)	1.42	*	(1.05, 1.91)	1.56	*	(1.10, 2.22)
LR Chi-squared	**498.0**	*******		**95.8**	*******		**18.6**		

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00. Notes: Controlling for age, residence characteristics, personal migration history, family demographics (marital status, total number of years married, number of live births, whether or not raised children alone), childhood and adult SES characteristics, and BMI at the time of the survey.

Table 5.11. Multivariable model of past-week depression, hypertension and diabetes for older Mexican women by spousal migration history, binary measure, women currently divorced or separated only										
		Depression			**Hypertension**			**Diabetes**		
		(n=668)			**(n=654)**			**(n=653)**		
		OR		95% CI	OR		95% CI	OR		95% CI
Spouse Migration to the US		1.12		(0.69, 1.82)	1.49		(0.93, 2.39)	2.14	*	(1.20, 3.82)
LR Chi-squared		**80.7**	*******		**23.1**	*******		**41.4**	*******	

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00. Notes: Controlling for age, residence characteristics, personal migration history, family demographics (marital status, total number of years married, number of live births, whether or not raised children alone), childhood and adult SES characteristics, and BMI at the time of the survey.

Table 5.12. KHB models of past-week depression, hypertension and diabetes for older Mexican women by spousal migration history for women currently not in a union (widowed, divorced, separated)										
		Depression			**Hypertension**			**Diabetes**		
		(n=2255)			**(n=2210)**			**(n=2212)**		
		OR		95% CI	OR		95% CI	OR		95% CI
Spouse Migration to the US										
	Reduced model (without raising children alone)	1.26		(0.98, 1.62)	1.41	**	(1.11, 1.81)	1.71	***	(1.28, 2.29)
	Full model	1.15		(0.89, 1.49)	1.41	**	(1.10, 1.81)	1.73	***	(1.29, 2.33)
	Difference	1.10		(1.04, 1.16)	1.00		(0.95, 1.04)	0.99		(0.94, 1.06)

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00. Notes: Controlling for age, residence characteristics, personal migration history, family demographics (marital status, total number of years married, number of live births, whether or not raised children alone), childhood and adult SES characteristics, and BMI for models of hypertension and diabetes only.

Table 5.13. Multivariable model predicting whether or not one's spouse ever migrated to the US to live or work, for a nationally representative sample of Mexican women born before 1951 with some marital history (n=6240)

	OR		95% CI
Age	0.96	**	(0.93, 0.99)
Years exposed to Bracero Era[a]	1.07	***	(1.03, 1.12)
Early Childhood SES			
No sanitation in household before age 10	1.70	***	(1.45, 2.01)
Serious health problem before age 10	1.12		(0.90, 1.39)
Respondent had no education	0.71	***	(0.60, 0.85)
R's mother had no education	0.86		(0.73, 1.01)
Don't know mother's education	1.27	*	(1.00, 1.62)
LR Chi-squared	**86.63**	***	

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.001.

Table 5.14. Average treatment effects of spousal migration on past-week depression, hypertension and diabetes for older Mexican women for women with and without histories of spousal migration to the US

	Depression		Hypertension		Diabetes	
	(n=6211)		(n=6087)		(n=6228)	
Average treatment effects (ATE)	0.01		0.05	*	0.02	
Average treatment effects on the treated (ATET)	0.02		0.04	*	0.04	*

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.001. Notes: Variables used to construct propensity scores include age, years of exposure to the Bracero Era, and childhood socio-economic status and health.

Table 5.15. Average treatment effects of spousal migration on past-week depression, hypertension and diabetes for older Mexican women for women with and without histories of spousal migration to the US, for those currently not in a union

	Depression		Hypertension		Diabetes	
	(n=2399)		(n=2351)		(n=2354)	
Average treatment effects (ATE)	0.02		0.08	*	0.08	*
Average treatment effects on the treated (ATET)	0.05		0.07	*	0.09	**

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.001. Notes: Variables used to construct propensity scores include age, years of exposure to the Bracero Era, and childhood socio-economic status and health.

Table 5.16. Logistic regression models of depression for older Mexican women by spousal migration history with interactions by labor history, personal migration history, and decision-making[a]

	Domestic Occupation			Respondent Migration			Decision-Making Power			Mastery		
	(n=5989)			(n=5989)			(n=3723)			(n=2169)		
	OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI
Spouse migrated to US	0.99		(0.84, 1.18)	0.97		(0.74, 1.26)	0.85		(0.69, 1.06)	1.15		(0.88, 1.49)
Domestic occupation (ref = all other occupations)	1.28	**	(1.10, 1.50)									
Domestic occupation*spousal migration	0.80		(0.54, 1.17)									
Respondent migrated (primarily internal)				1.12		(0.99, 1.27)						
Respondent migrated*spousal migration				0.98		(0.72, 1.35)						
Respondent has less decision-making power within family[b]							1.06		(0.88, 1.27)			
Less decision-making*spousal migration							1.17		(0.76, 1.80)			
Level of mastery, mean centered[c]										0.88	**	(0.81, 0.97)
Mastery*spousal migration										1.01		(0.79, 1.28)

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status, migration history, time married, number of live births, raising children alone, and childhood and adult SES characteristics; b. only for respondents that are currently married; c. only for those respondents not currently married.

Table 5.17. Logistic regression models of hypertension for older Mexican women by spousal migration history with interactions by labor history, personal migration history, and decision-making[a]

	Domestic Occupation			Respondent Migration			Decision-Making Power			Mastery		
	(n=5972)			(n=5972)			(n=3710)			(n=2165)		
	OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI
Spouse migrated to US	1.10		(0.94, 1.29)	1.37	*	(1.06, 1.77)	0.85		(0.69, 1.05)	1.38	*	(1.07, 1.77)
Domestic occupation (ref = all other occupations)	1.09		(0.94, 1.27)									
Domestic occupation*spousal migration	0.93		(0.64, 1.36)									
Respondent migrated (primarily internal)				1.06		(0.94, 1.19)						
Respondent migrated*spousal migration				0.72	*	(0.53, 0.98)						
Respondent has less decision-making power within family[b]							0.99		(0.83, 1.18)			
Less decision-making*spousal migration							1.60	*	(1.05, 2.44)			
Level of mastery, mean centered[c]										0.93		(0.86, 1.02)
Mastery*spousal migration										1.33	*	(1.05, 1.69)

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status, migration history, time married, number of live births, raising children alone, and childhood and adult SES characteristics; b. only for respondents that are currently marrie; c. only for those respondents not currently married.

Table 5.18. Logistic regression models of diabetes for older Mexican women by spousal migration history with interactions by labor history, personal migration history, and decision-making[a]

	Domestic Occupation (n=5980)			Respondent Migration (n=5980)			Decision-Making Power (n=3716)			Mastery (n=2167)		
	OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI
Spouse migrated to US	1.05		(0.86, 1.29)	1.34		(0.99, 1.82)	0.96		(0.73, 1.25)	1.67	**	(1.25, 2.26)
Domestic occupation (ref = all other occupations)	0.91		(0.76, 1.10)									
Domestic occupation*spousal migration	1.81	**	(1.18, 2.79)									
Respondent migrated (primarily internal)				0.89		(0.77, 1.03)						
Respondent migrated*spousal migration				0.83		(0.57, 1.19)						
Respondent has less decision-making power within family[b]							1.15		(0.92, 1.42)			
Less decision-making*spousal migration							1.06		(0.63, 1.77)			
Level of mastery, mean centered[c]										0.82	**	(0.74, 0.92)
Mastery*spousal migration										1.14		(0.87, 1.50)

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status, migration history, time married, number of live births, raising children alone, and childhood and adult SES characteristics; b. only for respondents that are currently married; c. only for those respondents not currently married.

Table 5.19. Logistic regression models of depression for older Mexican women by spousal migration history with interactions by labor history, personal migration history, and decision-making[a]

	Domestic Occupation			Respondent Migration			Decision-Making Power		
	(n=5989)			(n=5989)			(n=3714)		
	OR		95% CI	OR		95% CI	OR		95% CI
Spouse migrated to US	0.98		(0.83, 1.16)	0.96		(0.74, 1.25)	0.85		(0.69, 1.06)
Domestic occupation (ref = all other occupations, including no work history)	1.29	**	(1.11, 1.16)						
Domestic occupation+spousal migration	1.02		(0.74, 1.42)						
Respondent migrated (primarily internal)				1.12		(0.99, 1.27)			
Respondent migrated+spousal migration				1.05		(0.87, 1.28)			
Respondent has less decision-making power within family[b]							1.04		(0.87, 1.25)
Less decision-making+spousal migration							1.03		(0.72, 1.48)

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status, migration history, time married, number of live births, raising children alone, and childhood and adult SES characteristics; b. only for respondents that are currently married; c. only for those respondents not currently married.

Table 5.20. Logistic regression models of hypertension for older Mexican women by spousal migration history with interactions by labor history, personal migration history, and decision-making[a]

	Domestic Occupation			Respondent Migration			Decision-Making Power		
	(n=5877)			(n=5877)			(n=3641)		
	OR		95% CI	OR		95% CI	OR		95% CI
Spouse migrated to US	1.12		(0.95, 1.32)	1.41	*	(1.09, 1.83)	0.85		(0.69, 1.05)
Domestic occupation (ref = all other occupations, including no work history)	1.11		(0.96, 1.29)						
Domestic occupation + spousal migration	1.15		(0.83, 1.59)						
Respondent migrated (primarily internal)				1.09		(0.97, 1.22)			
Respondent migrated + spousal migration				1.08		(0.89, 1.30)			
Respondent has less decision-making power within family[b]							0.98		(0.82, 1.17)
Less decision-making + spousal migration							1.38		(0.97, 1.97)

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status, migration history, time married, number of live births, raising children alone, and childhood and adult SES characteristics; b. only for respondents that are currently marrie; c. only for those respondents not currently married.

Table 5.21. Logistic regression models of diabetes for older Mexican women by spousal migration history with interactions by labor history, personal migration history, and decision-making[a]

	Domestic Occupation			Respondent Migration			Decision-Making Power		
	(n=5885)			(n=5885)			(n=3647)		
	OR		95% CI	OR		95% CI	OR		95% CI
Spouse migrated to US	1.09		(0.89, 1.35)	1.45	*	(1.06, 1.98)	1.00		(0.76, 1.32)
Domestic occupation (ref = all other occupations, including no work history)	0.95		(0.90, 1.36)						
Domestic occupation+spousal migration	1.86	**	(1.29, 2.68)						
Respondent migrated (primarily internal)				0.94		(0.81, 1.10)			
Respondent migrated+spousal migration				1.09		(0.86, 1.38)			
Respondent has less decision-making power within family[b]							1.16		(0.92, 1.45)
Less decision-making+spousal migration							1.00		(0.65, 1.55)

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status, migration history, time married, number of live births, raising children alone, and childhood and adult SES characteristics; b. only for respondents that are currently married; c. only for those respondents not currently married.

Table 5.22. Four-by-four table of risk ratios of depression for additive interaction analysis of spousal migration and having adult children abroad for older Mexican women

	Spouse migrated to US	
Other Family to US	No	Yes
No	*Ref*	0.98, NS
Yes	1.37, p<0.001	1.13, NS

Source: Mexican Health and Aging Study, 2001. Controlling for age, residence characteristics, current marital status, migration history, time married, number of live births, raising children alone, and childhood and adult SES characteristics

Table 5.23. Four-by-four table of risk ratios of diabetes for additive interaction analysis of spousal migration and having adult children abroad for older Mexican women

	Spouse migrated to US	
Other Family to US	No	Yes
No	*Ref*	1.10, NS
Yes	0.95, NS	1.43, p<0.001

Source: Mexican Health and Aging Study, 2001. Controlling for age, residence characteristics, current marital status, migration history, time married, number of live births, raising children alone, and childhood and adult SES characteristics

Chapter 6: U.S. Migration as a Mediator or Moderator of the Relationship between Early Childhood Conditions and Later-Life Health

6.1 Introduction

The objective of this chapter is to test the relationship between U.S. migration experiences—either personal or among respondents' spouses—to other life-course predictors of later-life health. Specifically, I test whether or not U.S. migration experiences might *mediate* some of the relationship between early childhood disadvantage and later-life health. That is, does U.S. migration experience partly explain any significant relationship between childhood circumstances and later-life health that I uncover here? I already know from the propensity score matching exercises in the two previous chapters that some childhood indicators of SES and health significantly predict U.S. migration and spousal migration to the U.S., and that U.S. migration in some cases is significantly associated with later-life health, which might indicate a mediated relationship between childhood indicators and later-life health.

In addition to the mediation analysis, I test whether or not U.S. migration experiences might *moderate* the association between childhood health and socio-economic disadvantages and later-life depression, hypertension, or diabetes. It may be, for example, that U.S. migration might have improved socio-economic standing in adulthood relative to earlier life, which may potentially buffer the effect of childhood poverty on later-life health. On the other hand, the adverse impacts of some migration experiences – as I have found in the case of spousal migration for older Mexican women no longer in a union—might exacerbate the impact of poor childhood socio-economic or health conditions on later life health by adding to economic and family-related stressors. Some of the exacerbating effects of U.S. migration experience on the association between early-life influences and later-life chronic disease might result from the fact that return U.S. migrants and the family members of U.S. migrants have increased purchasing power and are able to consume more highly caloric food products. Changes in food preferences and patterns of consumption as the result of U.S. migration experience might also contribute to shifts in the relationship between early life indicators and later-life chronic disease. For example, while lower SES in rural and Southern Mexico continues to be associated with lower rates of chronic disease, particularly among men (i.e. the reverse SES gradient in health) because of the lower consumption of high-calorie processed foods and alcohol products among those with few financial means in these areas, those with some U.S. migration experience, including through the influences of U.S. migrant family members, might prefer to consume these same processed food products even at the same economic level (Creighton et al., 2011).

Despite the potential for migration to moderate the relationship between early life socio-economic status and later-life health, the absence of significant interaction effects would suggest that early-life influences persist unchanged even by the potentially significant life transition of U.S. migration or the U.S. migration of family members. As discussed earlier in the theoretical framework, we might expect that these early life experiences have become "embedded" enough to at least not be substantially mitigated by mid-life experiences, including U.S. migration experience.

6.2 Review of Descriptive Statistics

I presented descriptive statistics of childhood socio-economic and health conditions, stratified by U.S. migration variables, in the previous two results chapters (Table 4.1 and 5.1, in results chapters one and two). To review, I show that about 68% of male respondents who report no U.S. migration experience compared to 77% of return U.S. migrant men report having no sanitation facilities before age 10. Results were similar for women, with about 65% of women who reported no spousal migration to the U.S. lacking sanitation facilities compared with up to 74% of those who reported spousal migration. Between 10 and 14% of male respondents reported a serious illness that kept them from their normal activities for a month or more, with higher percentages attributed to return U.S. migrants. The rates were similar for women, although they varied slightly less by categories of spousal migration to the U.S. About a third of respondents across U.S. return migrant and non-migrant groups who completed follow-up interviews in 2003 reported frequently going to bed hungry before age 10.

Between 20 and 25% of men reported having no formal education, with higher rates for return U.S. migrant men. Women were more likely to report no formal educational attainment; between 24 and 32% reported no formal education, with no clear differences based on spousal migration to the U.S. Over half of male respondents reported their mother had no formal education, an indicator of early life socio-economic status, although a slightly higher percentage of return U.S. migrant men (12% compared to 8% of non-migrants) reported not knowing their mother's education. This may be confounded with age, given that return U.S. migrants are older on average, and may have more difficulty recalling. Around 50% of female respondents reported their mother had no formal education, although as with the male respondents those who reported spousal migration to the U.S. were more likely to report not knowing their mother's education (between 11 and 13% of those who reported spousal migration to the U.S. did not know compared to between 8 and 9% of those without).

Finally, the majority of respondents reported that their father's worked primarily in agricultural occupations[46], with significant differences by U.S. migration history: 56% of male respondents with no U.S. migration experience reported their fathers worked in agriculture compared with 68% of return U.S. migrants. Figures were similar for female respondents with and without a history of spousal migration to the U.S. The next most common paternal occupations reported were construction, gardening, restaurant, and then office or other work. Between 4 and 6% of respondents reported not knowing their father's occupation or that they did not know their father. In sum, both men and women with U.S. migration experience, either personal migration in the case of men or spousal migration in the case of women, report more early-life disadvantage compared to their counterparts without US migration experience.

6.3 Simple Analyses, Early Childhood and Health

I first review associations between indicators of childhood socio-economic and health conditions and later-life health without controls before I go on to multivariable models, and tests of mediators and moderators. In Tables 6.1 and 6.2 I show simple analyses for all three binary outcome variables separately for men and women, given that their U.S. migration measures will be different (personal U.S. migration versus spousal U.S. migration) in the later analyses. Tables 6.3 and 6.4 show analogous results using the continuous measures of depressive symptoms as the outcome variable.

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[46] I collapse the very small number of cases who reported their father's did domestic work or were unemployed into the agricultural category, based on the results estimating similar health outcomes for these groups. I test further collapsing categories into a binary measure later in the chapter (i.e. agriculture, domestic, no work, and don't know versus construction, gardening, restaurant or office work, or other occupation).

Overall, there are many significant simple associations between each of the measures of childhood circumstances and later-life health. There was some variation by gender and health outcome, with the exception of the linear model of continuous depressive symptoms, in which case each childhood indicator was significantly associated with later-life depressive symptoms for both men and women. Reporting a serious illness before age 10 is significantly associated with greater odds of depression, diabetes and hypertension for both men and women, whereas reporting no household sanitation facilities is associated with greater odds of depression and hypertension for women, and hypertension only for men. For women, reporting that one's mother had no formal education or not knowing mother's education are each significantly associated with greater odds of all three health conditions compared to respondents whose mothers had any formal education; this measure was only significantly associated with depression for men.

Among the variables added in the 2003 questionnaire, reporting that one's father had any other occupation aside from agriculture was associated with significant lower odds of depression for women; reporting that one's father worked in an office or "other"[47] occupation was associated with significantly lower odds of diabetes compared to those whose fathers had agricultural occupations. Male respondents who reported that their fathers worked in construction, as a gardener, or in a restaurant, respectively, each had significantly lower odds of hypertension compared to those whose fathers were in agriculture. Respondents with fathers in any non-agricultural occupation were estimated to have significantly *greater* odds of diabetes compared to their counterparts whose fathers had agricultural jobs. Reporting frequent child

[47] I tested this category of "other" occupations separately and it consistently had results similar to the office occupational category; given the small size of the former, I grouped them together.

hunger before age 10 was associated with significantly greater odds of depression, hypertension, and diabetes for women. Frequent childhood hunger was significantly associated with greater odds of depression, but *lower* odds of diabetes for men.

These findings of mixed relationships between socio-economic status and later-life chronic disease are not surprising – although in general the results here point to a positive relationship between greater childhood socio-economic and health disadvantage and greater odds of later-life chronic health problems. Some populations in Mexico continue to show evidence of a reverse socio-economic gradient in health, whereby higher socio-economic status is associated with a higher prevalence of chronic health conditions (J. A. Rivera et al., 2002; Stevens et al., 2008). This trend is often observed in more rural areas of Mexico, and among men; the simple analyses support to some degree the mixed epidemiological profile by gender.[48] Overall the results point to many significant associations between early life socio-economic and health conditions and later-life depression, hypertension, and diabetes. In analyses that follow, I seek to test whether or not U.S. migration experience potentially explains some of the variance linking childhood circumstances to later-life health, or whether it potentially moderates this relationship.

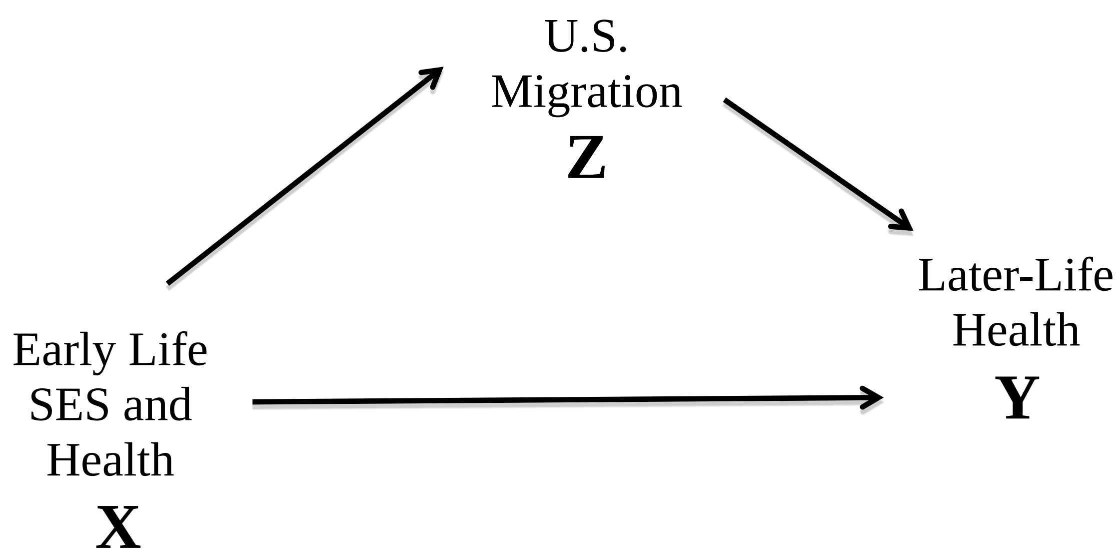
6.4 Mediation Analysis

As part of the analysis of U.S. migration experiences as a mediator of the life-course relationship between early life conditions and later-life health, I first show associations between early life conditions and U.S. migration. That is, in order for U.S. migration experience [Z] to mediate the relationship between childhood SES and health [X] and later-life health outcomes

[48] I also conduct sensitivity analyses for all models of moderation and mediation stratifying by rural and urban current residence given the somewhat different epidemiological patterns I might expect between childhood SES and health and later-life chronic disease, but find no divergent results compared to the models that do not stratify by residence characteristics.

[Y], I need to confirm not only that childhood SES and health are significantly associated with later-life health, but also with U.S. migration, as in Figure 6.1.

Figure 6.1. U.S. Migration Experience as Mediator between Early Life SES and Health and Later-Life Health Outcomes



In Table 6.5, I show relationships between early life SES and health and personal migration to the U.S. for men. The results suggest that higher levels of childhood disadvantage, including lacking sanitation facilities and experiencing a serious illness before age 10, having no formal education, and not knowing one's mother's education, are significantly associated with greater odds of being a return U.S. migrant (versus no migration or internal migration within Mexico only). Similar to my findings for the female respondents, reporting father's occupation in any non-agricultural sector is associated with significantly lower odds of being a return U.S.

migrant – likely because of the link between father's agricultural work and US migration experience, which is often an intergenerational enterprise.

In Table 6.6, I show that there are some significant associations between early life socio-economic status and health and spousal migration to the U.S., with some variation by categories of current marital status, which proved to be important in the association between spousal migration to the U.S. and later-life health. Specifically, not having sanitation facilities before age 10 is significantly associated with greater odds of reporting that a spouse migrated to the US for female respondents overall, regardless of current marital status. No formal education is significantly associated with lower odds of spousal migration to the U.S., as is reporting that one's father labored in any other occupation aside from agriculture (work in agriculture may be closely linked to father's own U.S. migration, which may increase the propensity for women to end up in a union with a partner who also migrates to the U.S.). Not knowing one's mother's education is significantly associated with greater odds of reporting spousal migration to the U.S. Overall, these results show some potential for spousal migration to the U.S. to mediate the relationship between some indicators of childhood socio-economic status and later-life health, particularly in the case of the household sanitation indicator.

It is notable that frequent childhood hunger is not significantly associated with either spousal or personal U.S. migration experience. Although frequent childhood hunger is significantly associated with later-life depression, hypertension, and diabetes, with variation by gender, it is not possible that the relationship is mediated by U.S. migration experience (Z), if there is no significant association. The same is true for serious childhood illness, which appears in to be a strong predictor of later-life health but not of spousal migration to the U.S.

U.S. Migration Experience as a Mediator

I now move on to further analyses of U.S. migration experience as a mediator of the life-course relationship between childhood circumstances and later-life health outcomes in multivariable models. I limit full tests of mediation to analyses in which I know from previous chapters that there is a significant association between U.S. migration experience and later-life health outcomes; that is, that Z significantly predicts Y. That means that I only run full tests of personal U.S. migration as a mediator in the case of depression for male respondents, given that this was the only outcome that U.S. migration significantly predicted in Chapter Four.

In Table 6.7 I show nested multivariable logistic regression models in which I include all of the childhood SES and health measures from the 2001 survey at once (Model 1), and then add demographic and residence indicators as controls (Model 2) [49]. Even when included all together, all of the early life indicators remain significant predictors of later-life depression for this sample of older men; they are still significant when controlling for demographic indicators. There is no reduction in the size of the effect or significance in the association between childhood SES and health and later-life depression when I add the indicator of return U.S. migration (Model 3), which is the first suggestion that U.S. migration is not necessarily a mediator of this life-course relationship. For completeness, I add the full set of adult socio-economic status measures in Model 4, which do appear to mediate the relationship between early-life socio-economic status and later-life depression. I present a similar set of nested models in Table 6.8 using the

[49] Because the indicator of childhood hunger was not significantly associated with U.S. return migration, and therefore not a candidate for mediation analyses, I did not include it in the full model. The indicator of father's occupation also largely fell away as a significant predictor of later-life health once included alongside other early life SES and health measures. I therefore decided to use only 2001 predictors, given the problem of attrition bias for analyses that only includes respondents who followed-up in 2003.

continuous measure of depressive symptoms as the outcome variable. If U.S. migration were a mediator in the relationship between early life conditions and later-life health, that would be clear from this set of linear regression models with a reduction in the size of early life regression coefficients and significance. That is clearly not the case here. Childhood SES and health measures do appear to be mediated in part by respondents' socio-economic status at the time of the survey.

In Tables 6.9 and 6.10 I show the results of logistic regression models estimating the relationship between early-life indicators and later-life hypertension and diabetes, respectively, although I do not perform the full mediation analyses in these cases. In both cases, reporting a serious illness before age 10 appears to be the most robust predictor of later-life health. Those who report having a serious illness before age 10 are estimated to have 38% greater odds of later-life hypertension ($p<0.001$) and 28% greater odds of later-life diabetes ($p<0.05$), even when controlling for other childhood and adult socio-economic and health indicators, as well as demographic and residence characteristics, and history of U.S. migration.

Given the problems with interpreting changes in logistic regression coefficients across models, I carried out a KHB decomposition analyses that allows for tests of mediation in logistic regression. In Table 6.11 I show that across analyses of all three health outcomes for men, there is no significant difference between models that include the U.S. migration indicator (labeled "full" models) and models that do not (labeled "reduced" models). This further confirms my finding that US migration experience does not appear to mediate the relationship between early life conditions and later-life health for this group of middle-aged and older Mexican men, even though early-life SES and health does significantly predict U.S. migration.[50]

Spousal Migration as a Mediator

In Tables 6.12 and 6.13 I begin to examine the potential for spousal migration to the U.S. to mediate the relationship between early life conditions and later-life health. As with the models for men, I end up focusing only on measures collected in 2001. In addition, I carry out the full set of nested models for the hypertension and diabetes outcomes only because I know from Chapter 5 that spousal migration to the U.S. significantly predicts these two outcomes and not depression.

I first include all 2001 childhood predictors in Model 1, and then add demographic, residence, and personal migration indicators in Model 2. This helps to control for potential confounding due to age, for example, or respondents' own migration within Mexico. I then control for spousal migration to the U.S. to assess any notable change in logistic regression coefficients (exponentiated as odds ratios) or significance levels. I try the binary indicator of spousal migration (Model 3) and the four-category measure that takes into account current marital status (Model 4).

Reporting a serious illness before age 10 and not knowing mother's education were each significant predictors of hypertension for middle-aged and older Mexican women in the multivariable models; reporting no sanitation facilities before age 10 was no longer significant

[50] I attempted these mediation analyses again with stratification by residence characteristics – more versus less urban and high U.S. out-migration state versus other state – and still found no evidence of mediation effects. See Appendix B for sensitivity analyses that re-run analyses for hypertension and diabetes restricting to respondents who report recent tests for hypertension or diabetes, who have a usual source of medical care, or who have health insurance coverage in Mexico.

after controlling for age, residence, and personal migration history. However, there were no qualitative changes to the size and significance level of these effects when adding in the measures of spousal migration to the U.S., which suggests the lack of a mediating effect. In addition, recall from Table 6.5 that having a serious illness before age 10 did not significantly predict spousal migration to the U.S. – that is, X did not significantly predict Z, which would be a requirement for mediation.

Similarly, the only significant early life predictor in the models of diabetes after controlling for demographic and residence characteristics is the indicator of a serious childhood illness. It does appear that there is a slight reduction in the size of the odds ratio and significance level of the measure of serious childhood illness after controlling for spousal migration to the U.S. Although, again, because serious childhood illness – the only significant early life predictor of later-life diabetes in the multivariable models – does not significantly predict spousal migration to the U.S, the conclusion is overwhelmingly that spousal migration could not be considered a mediator. For completeness, I show KHB decomposition analyses in Table 6.14, which confirms that there is no significant difference in models estimating the association between childhood conditions and later-life health that do and do not include spousal migration to the U.S.[51]

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[51] Because of the potential for different patterns in urban and rural areas, given the different stages of epidemiologic transition for urban and rural Mexico, I attempt all mediation models stratified by current residence (more or less urban), and find no significant mediation effects across these models. I also test models that stratify by whether or not respondents live in a historically high out-migration state or not, given that the relationship between early life socio-economic status and health might depend on how embedded U.S. migration networks are for residence of particular regions of Mexico. For example, areas with particularly high out-migration to the U.S. might contribute to lowered costs of migration through more established

Finally, Tables 6.15 and 6.16 show limited results for the binary and continuous depression measures, respectively. I find that reporting no sanitation facilities before age 10 is significantly associated with greater odds of depression (OR: 1.21, $p<0.01$) and so is reporting a serious illness before age 10 (OR: 1.61, $p<0.001$), even when controlling for other childhood and adult socio-economic measures, as well as demographic and residence characteristics, and family-related measures. The findings are qualitatively similar in the model using a continuous measure of depressive symptoms. There were significant associations between respondents' education and maternal education and later life depressive symptoms in Model 1, but those effects fell away once controlling for demographic and socio-economic measures in Model 2. I do not continue on with the full mediation analyses for depressive symptoms, given that spousal migration is not associated with depression and there is not a plausible mediation effect. However, these multivariable models form the bases for my tests of interaction effects to assess whether US migration moderates the relationship between early life conditions and later-life health.

6.5 US Migration as a Moderator

For male respondents, I test U.S. migration experience as a moderator of the relationship between early life conditions and later-life depression, hypertension and diabetes using both additive and multiplicative interaction approaches. I did not find any significant interaction terms between early-life measures and U.S. migration in the effect on any of the three health outcomes using the additive interaction approach (not shown). I did, however, find a couple of significant

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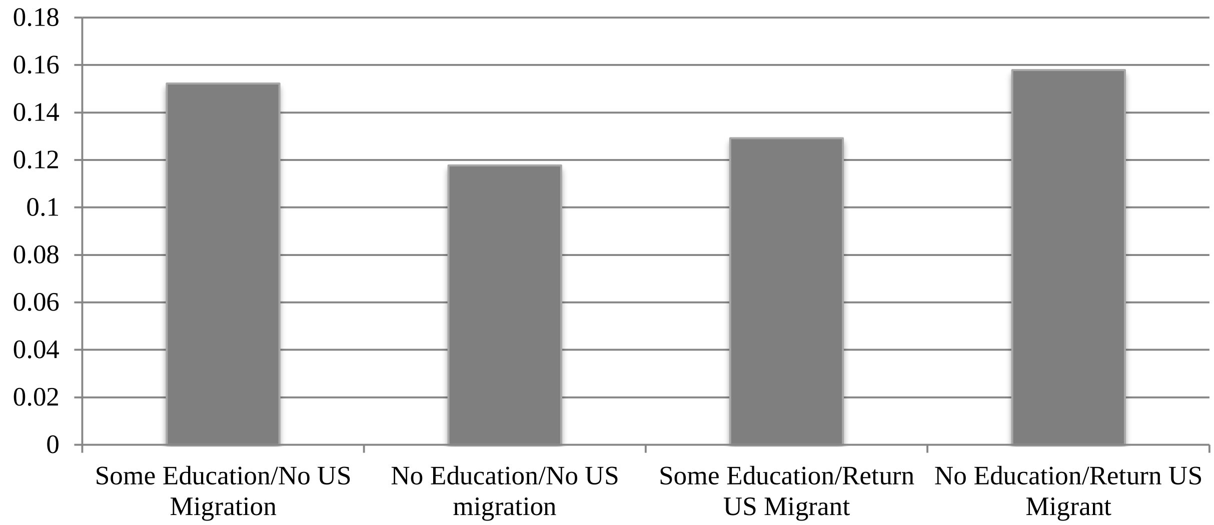
networks, which might allow even poorer individuals to migrate. Nevertheless, I find no evidence of spousal migration as a mediator of the life-course relationship between childhood conditions and later-life health when stratified by region.

interaction terms using the multiplicative approach. These findings should be interpreted with caution, given that the results represent tests of at least 12 multiplicative interaction models (and an additional 12 models using the additive interaction framework) and I would expect at least one significant result among these models simply due to chance.

In Table 6.17 I show a significant interaction term between the measure of no education and U.S. migration experience for the model of diabetes. Specifically, reporting both no formal educational attainment and being a return U.S. migrant appears to be associated with significantly greater odds of later-life diabetes compared to the reference group that reports a formal education and no US migration experience.[52] Interestingly, reporting no formal education but no U.S. migration experience is associated with significantly reduced odds of later-life diabetes (OR: 0.74, $p<0.05$) compared to the reference group with formal education and no U.S. migration experience (see also Figure 6. 2).

[52] The results are not significant once I control for adult SES characteristics, although I interpret this not to mean that the interaction term is not significant, but that the interaction between childhood SES and U.S. migration in the effect on later-life diabetes is mediated in part by adult SES (i.e. mediated moderation).

Fig. 6.2 Predicted Marginal Probabilities of Diabetes by Educational Attainment and US Migration Experience for Older Mexican Men, 2001 (n=5475)



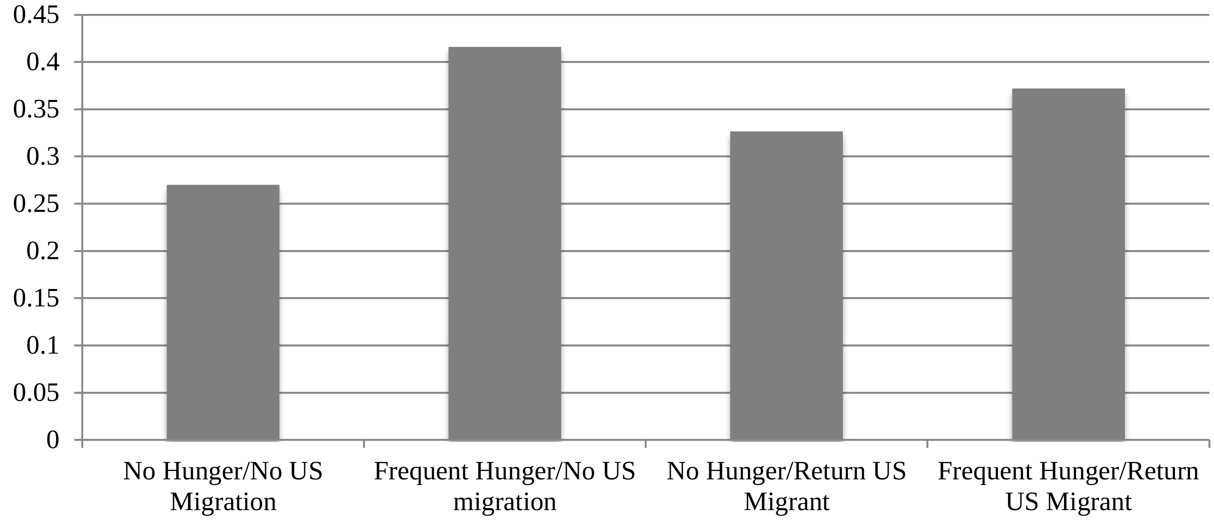
Source: Mexican Health and Aging Study, 2001. Controlling for age, marital status, residence characteristics, mother's education, childhood sanitation facilities, and childhood illness.

These results point in part to ways that U.S. migration might intersect with the socio-economic gradients in chronic disease outcomes in Mexico, and particularly for men. While male respondents with lower socio-economic status who have remained in Mexico for their lifetime have lower odds of later-life diabetes, consistent with the idea of the reverse SES gradient, those with lower SES but some U.S. migration experience appear to have odds of later-life diabetes that are consistent with the positive relationship between SES and health observed in more developed country contexts, as well as in more urban areas of Mexico (J. A. Rivera et al., 2002; Stevens et al., 2008).

The test of interaction effects between childhood hunger and U.S. migration experience on later-life depression suggests a slightly different pattern from the one described above for diabetes. In this case U.S. migration experience appears to buffer some of the adverse effects of childhood hunger on later-life depression. In Table 6.18 and Figure 6.3, I show that those who report both frequent childhood hunger and are return U.S. migrants are estimated to have significantly reduced odds of later-life depression compared to respondents who report frequent childhood hunger but no U.S. migration experience (OR: 0.63, $p<0.05$). On the other hand, reporting frequent hunger before age 10 without US migration experience is associated with 93% greater odds of later-life depression compared to those who report no frequent childhood hunger and no U.S. migration experience ($p<0.001$). These findings hint at the possibility that increases in social or economic standing through the experiences of working in the U.S. and returning to Mexico might buffer some of the adverse effects of childhood socio-economic and health-related adversity on later-life health, at least in the case of depression (Gonzalez Vazquez et al., 2007; López Castro, 1986; V.N. Salgado de Snyder, 2007). Without the potential for improved socio-economic status via laboring in the U.S. and returning to Mexico, childhood hunger continues to be associated with significantly greater odds of later-life depression.[53]

[53] This interaction effect remained significant after controlling for adult SES characteristics, which suggests that there might be some unmeasured aspect of social or economic status that accounts for the buffering effect of U.S. migration experience on the association between childhood hunger and later-life depression.

Fig. 6.3. Predicted Marginal Probabilities of Depression by Childhood Hunger and U.S. Migration Experience for Older Mexican Men, 2003 (n=4550)



Source: Mexican Health and Aging Study, 2001 and 2003. Controlling for age, marital status, residence characteristics, education, mother's education, household sanitation facilities during childhood, and serious illness during childhood.

The results of the interactions between education and U.S. migration experience in the case of diabetes and childhood hunger and U.S. migration in the case of depression support the idea that U.S. migration experience might alter the life-course relationship between childhood conditions and later-life health in either direction, by exacerbating *or* buffering the effects of childhood adversity. On the other hand, the overwhelming trend for these interaction models was that interaction terms between childhood socio-economic and health indicators and US migration experience were not significant predictors of later-life depression, hypertension, and diabetes. This makes me less confident in the claim that U.S. migration experience interrupts or changes the life-course relationship between childhood SES and health on the one hand and later-life health outcomes on the other. The results overall seem to support the strength of early life SES and health as predictors of later-life health outcomes for middle-aged and older Mexican men.

6.6 Spousal Migration as a Moderator

There were a number of significant interaction terms between early life conditions and spousal migration to the U.S. in multivariable models predicting later-life health. Specifically, there were significant interactions between serious childhood illness and frequent childhood hunger, respectively, and spousal migration to the U.S. in multivariable models of hypertension (Table 6.19). In both cases, the risk of later-life hypertension was significantly higher when respondents reported both childhood adversity and spousal migration to the U.S., meaning that spousal U.S. migration experience for women who largely remained in Mexico appears to exacerbate the adverse effect of childhood illness and hunger on later life hypertension (RR, serious illness before age 10: 1.87, $p<0.01$, 95% CI: 1.26, 2.77; RR, frequent hunger before age 10: 1.34, $p<0.05$, 95% CI: 1.03, 1.74).

Spousal migration appears to have a similar, exacerbating effect on the relationship between childhood poverty and health and later-life diabetes as well (Tables 6.20). Reporting a serious illness before age 10 and spousal migration to the U.S was associated with increased risk of doctor-diagnosed diabetes later in life compared to reporting no serious illness before age 10 and no spousal migration to the US (RR: 1.62, $p<0.05$, 95% CI: 1.03, 2.53). On the other hand, the terms representing serious childhood illness only (without spousal migration to the US) and spousal migration to the U.S. alone (without childhood illness) were each associated with significantly greater risk of diabetes compared to the reference category that reported neither childhood illness nor spousal migration. The four-by-four tables 6.21 and 6.22 depicts these relationships in the case of the interaction effects with serious childhood illness to more clearly present how both childhood disadvantage without spousal migration and childhood disadvantage with spousal migration to the U.S. are significantly associated with increased odds of later-life chronic disease.

Finally, in the model of depression, there were significant additive interactions between the measures of no sanitation facilities and frequent hunger before age 10, respectively, and spousal migration to the U.S. (Table 6.23). In each case the combination of childhood adversity (hunger, no sanitation facilities) and spousal migration to the U.S. was associated with greater estimated risk of later-life depression compared to the reference group who experienced neither the specific childhood condition nor spousal migration. However, it is again notable that those who reported any childhood disadvantage without spousal migration to the U.S. had significantly greater risk of later-life depression compared to those who reported childhood disadvantage but also no spousal migration to the U.S. That is, while the combined effect of childhood adversity and spousal migration to the U.S. might be associated with greater risk of later-life depression, childhood adversity *without* spousal migration to the U.S. might be worse.

I run the same tests using multiplicative interaction terms as well, but find less evidence of interaction between spousal migration to the U.S. and childhood conditions in their effect on later-life health. I find significant interaction effects only between the measure of no household sanitation facilities and the four-category measure of spousal migration to the U.S. and current marital status for models of hypertension and diabetes (Table 6.24). Specifically, it appears that women who report spousal migration and are not currently married have significantly greater odds of hypertension and diabetes when they *do* report sanitation facilities during childhood compared to their counterparts with the same spousal migration and current marital status who report *not* having household sanitation facilities as a child. Put differently, the predicted marginal probabilities of diabetes for female respondents who report having sanitation facilities and also spousal migration but are not in a union are 31.7% compared to 20.9% for their counterparts who report spousal migration and are not married, but did not have household sanitation facilities. By way of comparison, the range of predicted marginal probabilities across all other groups of female respondents by spousal migration and current marital status, regardless of sanitation facilities during childhood, is between 16 and 19%. Results are similar for the model of hypertension. These results confirm my findings from the previous results chapter that women who report spousal migration to the U.S. *and* are not currently married appear to be the most disadvantaged in terms of later-life hypertension and diabetes. However, it appears that this adverse effect is even more pronounced for respondents who report relative socio-economic privilege during childhood.

These results might suggest that spousal migration to the U.S. for women who are not currently married at the time of the survey during middle-age or older adulthood is worse for women who were raised with relative socio-economic advantages, perhaps if these women had less to gain economically from their spouses' departure to offset the negative aspects of increased burden with child-rearing and the stress of family separation. On the other hand, there is reason to be cautious about interpreting these interaction results, given that this is the only significant interaction term from at least 24 models run with interaction terms between early life measures and both binary and four-category measures of spousal migration to the U.S., as well as another ten multiplicative interaction models using the continuous measure of depressive symptoms as the outcome variable that were not significant (not shown). I would expect up to two of the interaction terms to be significant simply by chance. In addition, post-estimation F-tests to estimate the overall contribution of these four-by-two interaction terms to the multivariable models of hypertension and diabetes are not significant, which suggests that these interaction terms may not be useful overall in helping to better estimate each of the health outcomes.

6.7 Discussion

This chapter begins by confirming findings from other research on the life-course origins of later-life health outcomes for older adults in Mexico and Latin American more broadly (B. Alvarado, Zunzunegui, Beland, & Bamvita, 2008; Beltrán-Sanchez et al., 2011; Huang, Soldo, & Elo, 2011; Nguyen, Couture, Alvarado, & Zunzunegui, 2008; Torres & Wong, 2013) with simple and multivariable models of early life socio-economic and health outcomes as predictors of later-life depression, hypertension, and diabetes. There was a great deal of variation in these relationships by gender and health outcome. For example, there was evidence of a reverse socio-economic gradient between socio-economic status and later-life diabetes for men. However, for the most part, greater socio-economic disadvantage, including lacking sanitation facilities, experiencing a serious childhood illness, frequent childhood hunger, and lacking formal education all predicted greater odds of later-life chronic health problems.

Despite these significant life-course relationships between early-life conditions and later-life health, and despite the findings that many of these early-life measures also significantly predicted U.S. migration experience, there was evidence that U.S. migration did not mediate this life-course socio-economic and health trajectory. That is, the relationship between childhood conditions and later-life health do not appear to be explained by the fact that increased poverty during childhood is associated with greater propensity to migrate to the US, or to report that one's spouse migrated to the U.S. in the case of women.

There were mixed results for the tests of U.S. migration experience as a moderator of the relationship between childhood conditions and later-life health. Overall, there results were null for significant interaction terms between U.S. migration experience and early-life indicators for men. However, there were two compelling exceptions to the idea that early-life measures were unchanged by U.S. migration in their effect on later-life health outcomes. For one, the relationship between education and later-life diabetes for men with no U.S. migration experience was reflective of the reverse social gradient observed in some cases in Mexico, whereby those with lower levels of education were estimated to have lower odds of later-life diabetes (Buttenheim et al., 2010). This relationship was reversed among U.S. return migrants, for whom lower levels of education predicted higher odds of diabetes. This is the socio-economic gradient in health that is observed in developed countries, and for much of urban Mexico and among Mexican women. The effect of exposure to the U.S. appeared to flip the gradient to reflect what is seen in the U.S. (and urban Mexico) in the case of education and diabetes. Another study by Riosmena and co-authors (2012) finds that rural Mexican men, who have been slower to be impacted by the nutrition transition in Mexico, are particularly susceptible to the negative impacts of exposure to the US when it comes to risk factors for chronic disease. Specifically, the authors found a significant and positive association between the intensity of community-level U.S. migration and obesity for adult Mexican men responding to the Mexican National Health Survey (ENSA).

On the other hand, there was a slightly buffering effect in the case of childhood hunger and later-life depression. This might be suggestive of the idea that improved social and economic standing for return U.S. migrants might lead to some improvement in psychosocial resources for dealing with stressors that lessens the degree to which childhood social, economic, and health adversities lead to a pathway of increased depressive symptoms later in life. This idea of a diminished role for childhood socio-economic status in predicting later-life health outcomes for U.S .migrants resonates with the findings of early research on immigrant health. In their study of heart disease among Japanese men, Marmot and authors (1975) found that despite sharing similar early-life profiles, Japanese immigrants men living in Hawaii and California had increased risk of later-life heart disease compared to their non-migrant counterparts in Japan. The authors took this to mean that international migration, and the new psycho-social and health behavior context of the receiving context took over as the primary determinants of health. More recently, Al Hazzouri and colleagues (2011) compared the effect of early-life socio-economic status on the cognitive functioning of older Mexican migrants to the US and non-US migrants using the MHAS and a U.S.-based study with Mexican immigrant and Mexican-American respondent pool. They estimated that a weaker association between paternal education and later-life cognitive functioning for those who had migrated to the U.S. for any time period, including return U.S. migrants living in Mexico compared to Mexican men who never migrated, suggesting that childhood SES diminished in its influence on later-life health given the experience of international migration.

The tests of interaction effects between childhood socio-economic and health measures and spousal migration to the U.S. were more consistently significant, at least when using an additive interaction methodology. In these cases, spousal migration appears to exacerbate the adverse effects of poverty or serious illness on later-life health for female respondents. These findings might reflect the fact that, at least for middle-age and older adult Mexican women not in a union by the time of the survey, spousal migration to the U.S. was more consistently a risk factor for later-life health, which compounded the effects of other life-course risk factors, rather than the mitigation effects seen with childhood hunger and U.S. migration experience for men. On the other hand, the women in this sample – as is the overall trend in Mexico – were less likely to have reverse social gradients in health outcomes than men. This means that there is less opportunity for the exports of U.S. migration experience – financial, cultural, and social – to influence health behavior and chronic disease risk so as to influence the very nature of the SES gradient in health, as with the case of education and U.S. migration experience in the effect on later-life diabetes for men (Riosmena et al., 2012). These results point to the potential importance of considering migration experiences within the entire life-course socio-economic and health context, given the potential for the U.S. migration of family members in this case, to amplify the effects of these life-course predictors.

The public health literature on international migration seldom considers migration within the context of a migrant's entire life-course, despite the growing body of research that exposures to adverse socio-economic and health conditions during childhood in particular have a strong influence on later-life health. Although the results here do not support U.S. migration experience as a mediator of this life-course relationship, and provide weak support for a moderation effect, this chapter provides a model for how early life conditions and migration might both be taken into account in health research. The Mexican Health and Aging Survey provides a unique opportunity to integrate the life-course perspective with research on the health of migrants – in this case return US migrants – and their family members. The same line of inquiry would be impossible for the vast majority of U.S.-based health surveys. The results here suggest that childhood socio-economic and health conditions continue to be important predictors of later-life health despite 'turning points' like US migration experience, and should be integrated into immigrant health research both in future studies in sending countries like Mexico, but also in receiving contexts in the US.

6.8 Tables

Table 6.1. Simple logistic regression models of depression, hypertension and diabetes for older Mexican women by indicators of childhood health and socio-economic status.

	Five or more depressive symptoms (n=6741)			Doctor-diagnosed hypertension (n=6600)			Doctor Diagnosed Diabetes (n=6606)		
2001 Characteristics	OR		95% CI	OR		95% CI	OR		95% CI
No sanitation facilities before age 10	1.64	***	(1.48, 1.82)	1.16	**	(1.04, 1.28)	1.08		(0.94, 1.23)
Serious illness before age 10	1.63	***	(1.40, 1.90)	1.26	**	(1.08, 1.47)	1.39	**	(1.15, 1.67)
R has no education	1.72	***	(1.54, 1.92)	1.04		(0.93, 1.16)	1.16	*	(1.01, 1.34)
Mother has no education	1.46	***	(1.32, 1.62)	1.12	*	(1.01, 1.24)	1.20	**	(1.05, 1.37)
Don't know mother's education	1.35	**	(1.13, 1.61)	1.31	**	(1.10, 1.56)	1.16		(0.92, 1.46)
2003 Characteristics	**(n=5806)**			**(n=5792)**			**(n=5784)**		
Father's occupation (Ref=Agriculture)									
Construction	0.81	**	(0.69, 0.95)	1.05		(0.89, 1.22)	1.13		(0.92, 1.38)
Garden	0.65	***	(0.54, 0.79)	1.03		(0.86, 1.24)	1.13		(0.89, 1.42)
Restaurant	0.67	***	(0.54, 0.82)	0.96		(0.79, 1.18)	0.81		(0.61, 1.07)
Office or other	0.61	***	(0.50, 0.75)	0.87		(0.71, 1.06)	0.69	*	(0.51, 0.91)
No parent/don't know	1.03		(0.82, 1.29)	1.02		(0.81, 1.28)	1.01		(0.75, 1.36)
Frequently went to bed hungry before age 10	2.52	***	(2.24, 2.83)	1.13	*	(1.01, 1.27)	1.16	*	(1.01, 1.34)

Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.001

Table 6.2. Simple logistic regression models of depression, hypertension and diabetes for older Mexican men by indicators of childhood health and socio-economic status.

	Five or more depressive symptoms (n=5504)			Doctor-diagnosed hypertension (n=5700)			Doctor Diagnosed Diabetes (n=5507)		
2001 Characteristics	OR		95% CI	OR		95% CI	OR		95% CI
No sanitation facilities before age 10	0.94		(0.83, 1.07)	1.62	***	(1.41, 1.85)	0.95		(0.81, 1.12)
Serious illness before age 10	1.68	***	(1.41, 2.01)	1.39	***	(1.17, 1.66)	1.26	*	(1.00, 1.57)
R has no education	1.93	***	(1.69, 2.21)	0.87		(0.75, 1.00)	0.81	*	(0.67, 0.98)
Mother has no education	1.62	***	(1.42, 1.85)	0.93		(0.82, 1.05)	0.99		(0.85, 1.17)
Don't know mother's education	1.55	***	(1.25, 1.93)	0.93		(0.75, 1.15)	1.07		(0.81, 1.41)
2003 Characteristics	**(n=4617)**			**(n=4604)**			**(n=4597)**		
Father's occupation (Ref = Agriculture)									
Construction	1.09		(0.90, 1.32)	0.77	*	(0.63, 0.95)	1.55	***	(1.22, 1.98)
Garden	1.26	*	(1.02, 1.58)	0.65	**	(0.51, 0.84)	1.46	*	(1.10, 1.94)
Restaurant	1.17		(0.90, 1.53)	0.61	**	(0.45, 0.82)	1.46	*	(1.04, 2.06)
Office or other	1.24		(0.98, 1.57)	0.88		(0.69, 1.14)	1.51	**	(1.12, 2.04)
No parent/don't know	1.14		(0.83, 1.56)	0.77		(0.55, 1.08)	1.33		(0.88, 2.01)
Frequently went to bed hungry before age 10	2.09	***	(1.84, 2.40)	0.98		(0.85, 1.12)	0.80	*	(0.67, 0.96)

Source: Mexican Health and Aging Study, 2001 and 2003, *p<0.05, **p<0.01, ***p<0.001

Table 6.3. Simple linear regressions of depressive symptoms on indicators of childhood health and socio-economic status for older Mexican women.				
		(n=6755)		
2001 Characteristics		B		SE
No sanitation facilities before age 10		0.78	***	(0.07)
Serious illness before age 10		0.75	***	(0.11)
R has no education		0.75	***	(0.07)
Mother has no education		0.64	***	(0.07)
	Don't know mother's education	0.57	***	(0.12)
2003 Characteristics		**(n=5806)**		
Father's occupation (Ref = Agriculture)				
	Construction	-0.34	**	(0.11)
	Garden	-0.60	***	(0.13)
	Restaurant	-0.61	***	(0.14)
	Office or other	-0.60	***	(0.13)
	No parent/don't know	0.09		(0.15)
Frequently went to bed hungry before age 10		1.42	***	(0.07)

Source: Mexican Health and Aging Study, 2001 and 2003, *p<0.05, **p<0.01, ***p<0.001

Table 6.4. Simple linear regressions of depressive symptoms on indicators of childhood health and socio-economic status for older Mexican men.

	(n=5715)		
2001 Characteristics	B		SE
No sanitation facilities before age 10	0.72	***	(0.07)
Serious illness before age 10	0.57	***	(0.10)
R has no education	0.94	***	(0.08)
Mother has no education	0.67	***	(0.07)
Don't know mother's education	0.52	***	(0.12)
2003 Characteristics	**(n=4617)**		
Father's occupation (Ref = Agriculture)			
Construction	-0.34	**	(0.11)
Garden	-0.61	***	(0.13)
Restaurant	-0.65	***	(0.15)
Office or other	-0.49	***	(0.13)
No parent/don't know	-0.15		(0.18)
Frequently went to bed hungry before age 10	1.06	***	(0.08)

Source: Mexican Health and Aging Study, 2001 and 2003, *p<0.05, **p<0.01, ***p<0.001

Table 6.5. Simple logistic regression models of migration to the US for older Mexican men by indicators of childhood health and socio-economic status.

	US migrant (n=5688)		
2001 Characteristics	OR		95% CI
No sanitation facilities before age 10	1.64	***	(1.36, 1.89)
Serious illness before age 10	1.46	***	(1.19, 1.79)
R has no education	1.24	**	(1.06, 1.47)
Mother has no education	1.06		(0.92, 1.24)
Don't know mother's education	1.58	***	(1.24, 2.00)
2003 Characteristics	**US migrant (n=4623)**		
Father's occupation (Ref = Agriculture)			
Construction	0.54	***	(0.42, 0.71)
Garden	0.66	**	(0.50, 0.89)
Restaurant	0.68	*	(0.48, 0.96)
Office or other	0.55	***	(0.39, 0.77)
No parent/don't know	0.69		(0.46, 1.05)
Frequently went to bed hungry before age 10	0.94		(0.77, 1.07)

Source: Mexican Health and Aging Study, 2001 and 2003, *p<0.05, **p<0.01, ***p<0.001

Table 6.6. Simple logistic regression models of spousal migration to the US for older Mexican women by indicators of childhood health and socio-economic status.

	Spouse to US - all women (n=6420)			Spouse to US - married (n=3830)			Spouse to US - not married (n=2410)		
2001 Characteristics	OR		95% CI	OR		95% CI	OR		95% CI
No sanitation facilities before age 10	1.54	***	(1.32, 1.80)	1.61	***	(1.33, 1.96)	1.42	**	(1.10, 1.83)
Serious illness before age 10	1.10		(0.89, 1.37)	1.12		(0.87, 1.47)	1.06		(0.74, 1.53)
R has no education	0.83	*	(0.71, 0.98)	0.89		(0.73, 1.09)	0.77		(0.60, 1.00)
Mother has no education	0.92		(0.79, 1.07)	0.92		(0.76, 1.10)	0.95		(0.74, 1.23)
Don't know mother's education	1.37	**	(1.08, 1.73)	1.39	*	(1.03, 1.87)	1.40		(0.96, 2.04)
2003 Characteristics	**(n=5387)**			(n=3352)			(n=2035)		
Father's occupation (Ref=Agriculture)									
Construction	0.62	***	(0.48, 0.79)	0.59	**	(0.43, 0.80)	0.68		(0.45, 1.02)
Garden	0.59	***	(0.44, 0.79)	0.54	**	(0.37, 0.79)	0.67		(0.42, 1.09)
Restaurant	0.84		(0.63, 1.12)	0.65	*	(0.45, 0.94)	1.32		(0.83, 2.08)
Office or other	0.63	**	(0.46, 0.85)	0.59	*	(0.39, 0.88)	0.71		(0.44, 1.15)
No parent/don't know	0.57	**	(0.39, 0.82)	0.60	*	(0.38, 0.93)	0.53		(0.28, 1.01)
Frequently went to bed hungry before age 10	1.08		(0.92, 1.27)	1.04		(0.85, 1.27)	1.16		(0.89, 1.52)

Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.001

Table 6.7. Multivariable logistic regression models of depression for older Mexican men by indicators of childhood health and socio-economic status (n=5567)

	Model 1 (Childhood Only)			Model 2 (Add Demographics)			Model 3 (Add US Migration History)			Model 4 (Add Adult SES Controls[a])		
2001 Childhood characteristics	OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI
No sanitation facilities before age 10	1.33	***	(1.15, 1.54)	1.27	**	(1.09, 1.47)	1.27	**	(1.09, 1.48)	1.12		(0.96, 1.31)
Serious illness before age 10	1.73	***	(1.45, 2.07)	1.74	***	(1.45, 2.08)	1.74	***	(1.45, 2.09)	1.68	***	(1.40, 2.02)
R has no education	1.63	***	(1.41, 1.88)	1.40	***	(1.20, 1.63)	1.40	***	(1.20, 1.63)	1.25	**	(1.07, 1.46)
Mother has no education	1.31	***	(1.14, 1.51)	1.25	**	(1.08, 1.44)	1.25	**	(1.08, 1.44)	1.11		(0.96, 1.29)
Don't know mother's education	1.35	**	(1.08, 1.69)	1.24		(0.98, 1.55)	1.24		(0.99, 1.56)	1.14		(0.91, 1.44)
Demographics												
Age, years				1.02	***	(1.01, 1.03)	1.02	***	(1.01, 1.03)	1.02	***	(1.01, 1.03)
Urban residence				0.89		(0.78, 1.02)	0.89		(0.78, 1.02)	1.06		(0.91, 1.23)
High out-migration state				1.26	**	(1.10, 1.44)	1.27	**	(1.10, 1.45)	1.34	***	(1.16, 1.54)
Marital status (ref=married)												
Single				1.23		(0.85, 1.79)	1.23		(0.84, 1.78)	1.14		(0.78, 1.67)
Divorced/separated				1.79	***	(1.40, 2.30)	1.80	***	(1.40, 2.30)	1.59	***	(1.23, 2.05)
Widowed				1.97	***	(1.61, 2.42)	1.97	***	(1.61, 2.41)	1.94	***	(1.57, 2.38)
Return US migrant							0.97		(0.82, 1.15)	1.01		(0.86, 1.20)
Adult SES												
Agriculture as primary occupation										0.99		(0.86, 1.16)
Poor self-rated economic situation										1.97	***	(1.64, 2.37)
Household items (range: 0-6)										0.89	***	(0.86, 0.93)

Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.001. Notes: a. Controlling for lifetime occupational status (agricultural/domestic versus other), number of items in R's household, ranging from 0-6 items, and poor self-rated economic status.

Table 6.8. Multivariable linear regression models of depressive symptoms for older Mexican men by indicators of childhood health and socio-economic status (n=5567)

	Model 1 (Childhood Only)			Model 2 (Add Demographics)			Model 3 (Add US Migration History)			Model 4 (Add Adult SES Controlsa)		
2001 Childhood characteristics	B		SE	B		SE	B		SE	B		SE
No sanitation facilities before age 10	0.45	***	(0.07)	0.39	***	(0.07)	0.39	***	(0.07)	0.21	**	(0.08)
Serious illness before age 10	0.58	***	(0.10)	0.56	***	(0.10)	0.57	***	(0.10)	0.51	***	(0.10)
R has no education	0.68	***	(0.08)	0.47	***	(0.08)	0.47	***	(0.08)	0.32	***	(0.09)
Mother has no education	0.36	***	(0.07)	0.30	***	(0.07)	0.30	***	(0.07)	0.14		(0.07)
Don't know mother's education	0.32	**	(0.12)	0.20		(0.12)	0.20		(0.12)	0.08		(0.11)
Demographics												
Age, years				0.03	***	(0.01)	0.03	***	(0.01)	0.03	***	(0.01)
Urban residence				-0.11		(0.07)	-0.11		(0.07)	0.11		(0.08)
High out-migration state				0.27	***	(0.07)	0.28	***	(0.07)	0.34	***	(0.07)
Marital status (ref=married)												
Single				0.28		(0.20)	0.28		(0.20)	0.20		(0.20)
Divorced/separated				0.62	***	(0.14)	0.62	***	(0.14)	0.46	**	(0.14)
Widowed				0.94	***	(0.12)	0.94	***	(0.12)	0.90	***	(0.12)
Return US migrant							-0.05		(0.09)	0.01		(0.00)
Adult SES												
Agriculture as primary occupation										0.05		(0.08)
Poor self-rated economic situation										0.81	***	(0.08)
Household items (range: 0-6)										-0.13	***	(0.02)

Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.001. Notes: a. Controlling for lifetime occupational status (agricultural/domestic versus other), number of items in R's household, ranging from 0-6 items, and poor self-rated economic status.

Table 6.9. Multivariable logistic regression models of hypertension for older Mexican men by indicators of childhood health and socio-economic status (n=5443)					
	Model 1 (Childhood Only)			**Model 2 (Add Demographics, Migration History, Adult SES)[a]**		
2001 Childhood characteristics	OR		95% CI	OR		95% CI
No sanitation facilities before age 10	0.98		(0.86, 1.12)	1.03		(0.89, 1.18)
Serious illness before age 10	1.40	***	(1.17, 1.66)	1.38	***	(1.16, 1.66)
R has no education	0.89		(0.76, 1.03)	0.92		(0.78, 1.08)
Mother has no education	0.97		(0.85, 1.10)	1.02		(0.89, 1.17)
Don't know mother's education	0.97		(0.78, 1.21)	0.94		(0.75, 1.18)
Demographics						
Age, years				1.02	***	(1.02, 1.03)
Urban residence				1.02		(0.88, 1.18)
High out-migration state				1.01		(0.88, 1.16)
Marital status (ref=married)						
Single				1.21		(0.83, 1.76)
Divorced/separated				0.86		(0.66, 1.14)
Widowed				1.13		(0.91, 1.40)
Return US Migrant				1.04		(0.88, 1.22)
Adult SES						
Agriculture as primary occupation				1.04		(0.88, 1.22)
Poor self-rated economic situation				1.27	**	(1.09, 1.48)
Household items (range: 0-6)				1.09	***	(1.05, 1.14)
BMI (Ref= Underweight/Normal)						
Overweight				1.38	***	(1.19, 1.61)
Obese				1.94	***	(1.62, 2.33)
Don't know/refused				0.93		(0.76, 1.13)

Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.001.

Table 6.10. Multivariable logistic regression models of diabetes for older Mexican men by indicators of childhood health and socio-economic status (n=5447).						
	Model 1 (Childhood Only)			**Model 2 (Add Demographics, Migration History, Adult SES)a**		
2001 Childhood characteristics	OR		95% CI	OR		95% CI
No sanitation facilities before age 10	0.99		(0.83, 1.18)	1.20	*	(1.00, 1.44)
Serious illness before age 10	1.26	*	(1.00, 1.58)	1.27	*	(1.01, 1.60)
R has no education	0.79	*	(0.64, 0.97)	0.98		(0.79, 1.22)
Mother has no education	1.07		(0.90, 1.27)	1.19		(0.99, 1.42)
Don't know mother's education	1.14		(0.86, 1.50)	1.20		(0.91, 1.60)
Demographics						
Age, years				1.01	**	(1.00, 1.02)
Urban residence				1.16		(0.95, 1.41)
High out-migration state				0.89		(0.74, 1.06)
Marital status (ref=married)						
Single				0.78		(0.45, 1.35)
Divorced/separated				0.77		(0.53, 1.13)
Widowed				0.73	*	(0.53, 0.99)
Return US migrant				0.92		(0.74, 1.14)
Adult SES						
Agriculture as primary occupation				0.66	***	(0.54, 0.80)
Poor self-rated economic situation				1.09		(0.90, 1.32)
Household items (range: 0-6)				1.12	***	(1.05, 1.18)
BMI (Ref= Underweight/Normal)						
Overweight				1.12		(0.92, 1.35)
Obese				1.16		(0.92, 1.47)
Don't know/refused				0.76	*	(0.58, 0.99)

Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.001. Notes: a. Controlling for lifetime occupational status (agricultural/domestic versus other), number of items in R's household, ranging from 0-6 items, and poor self-rated economic status.

Table 6.11. KHB models of past-week depression, hypertension and diabetes for older Mexican men by early childhood circumstances and spousal migration history

		Depression			Hypertension			Diabetes		
		(n=5051)			(n=4877)			(n=4878)		
		Coef.		95% CI	OR		95% CI	OR		95% CI
No sanitation facilties before age 10										
	Reduced model (without US migration variable)	0.27	**	(0.11, 0.44)	0.05		(-0.10, 0.20)	0.07		(-0.12, 0.26)
	Full model	0.27	**	(0.11, 0.43)	0.04		(-0.10, 0.19)	0.07		(-0.12, 0.27)
	Difference	<0.01		(-0.01, 0.01)	0.01		(-0.01, 0.02)	<0.01		(-0.01, 0.01)
Serious illness before age 10										
	Reduced model (without US migration variable)	0.54	***	(0.35, 0.74)	0.36	***	(0.17, 0.55)	0.24		(-0.01, 0.49)
	Full model	0.54	***	(0.35, 0.74)	0.35	***	(0.16, 0.54)	0.24		(-0.01, 0.49)
	Difference	<0.01		(-0.01, 0.01)	0.01		(-0.01, 0.02)	<0.01		(-0.02, 0.01)
No formal education										
	Reduced model (without US migration variable)	0.42	***	(0.26, 0.57)	-0.15		(-0.32, 0.01)	-0.19		(-0.42, 0.03)
	Full model	0.42	***	(0.26, 0.57)	-0.15		(-0.32, 0.01)	-0.19		(-0.42, 0.03)
	Difference	<0.01		(-0.01, 0.01)	<0.01		(-0.01, 0.01)	<0.01		(-0.01, 0.01)

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00. Notes: Controlling for age, residence characteristics, and marital status

Table 6.12. Multivariate logistic regression models of hypertension for older Mexican women by indicators of childhood health and socio-economic status (n=5877).

	Model 1 (Childhood Only)			Model 2 (Add Age, Residence, Personal Migration)			Model 3 (Add Spousal Migration to U.S. - Four Category)			Model 4 (Add Family and Adult SES Controls)[a]			Model 5 (Add BMI)		
2001 Childhood characteristics	OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI			
No sanitation facilities before age 10	1.14	*	(1.02, 1.27)	1.12		(0.99, 1.25)	1.11		(0.90, 1.23)	1.07		(0.95, 1.21)	1.07		(0.94, 1.21)
Serious illness before age 10	1.26	**	(1.08, 1.47)	1.27	**	(1.09, 1.49)	1.29	**	(1.15, 1.70)	1.26	**	(1.07, 1.48)	1.24	**	(1.06, 1.47)
R has no education	0.96		(0.85, 1.08)	0.91		(0.81, 1.03)	0.92		(0.96, 1.33)	0.9		(0.79, 1.03)	0.91		(0.79, 1.04)
Mother has no education	1.10		(0.98, 1.23)	1.08		(0.97, 1.21)	1.09		(0.95, 1.29)	1.06		(0.94, 1.20)	1.06		(0.94, 1.20)
Don't know mother's education	1.29	**	(1.08, 1.54)	1.25	*	(1.04, 1.50)	1.23	*	(0.84, 1.37)	1.28	*	(1.06, 1.56)	1.25	*	(1.03, 1.53)
Demographics															
Age, years				1.02	***	(1.01, 1.02)	1.02	***	(0.99, 1.01)	1.01	***	(1.01, 1.02)	1.02	***	(1.01, 1.03)
Urban residence				1.02		(0.91, 1.14)	1.06		(1.06, 1.44)	1.00		(0.88, 1.14)	0.99		(0.87, 1.13)
High out-migration state				1.06		(0.95, 1.18)	1.03		(0.65, 0.89)	1.02		(0.90, 1.14)	1.03		(0.91, 1.16)
R migrated (mostly internal)				1.09		(0.98, 1.21)	1.07		(0.82, 1.08)	1.04		(0.93, 1.16)	1.04		(0.93, 1.16)
Marital status (ref=married)															
Divorced/separated															
Widowed															
Four-category spousal migration (Married, no US spouse)															
Not married, no US spouse							0.95		(0.75, 1.02)	0.94		(0.82, 1.09)	0.95		(0.82, 1.10)
Married, US spouse							1.08		(0.88, 1.39)	0.99		(0.83, 1.20)	0.99		(0.83, 1.20)
Not married, no US spouse							1.40	**	(1.15, 1.98)	1.25		(0.97, 1.62)	1.24		(0.95, 1.60)
Family Indicators															
Raised children alone										1.22	**	(1.07, 1.39)	1.22	**	(1.07, 1.39)
Number of live births										1.02	*	(1.01, 1.04)	1.02	*	(1.00, 1.04)
Total number of years married										1.00		(0.99, 1.01)	1.00		(0.99, 1.01)
Socio-economic indicators															
Domestic labor (ref = all other lifetime occupations)										1.08		(0.94, 1.25)	1.08		(0.94, 1.25)
Poor self-rated economic condition										1.27	**	(1.11, 1.46)	1.24	**	(1.08, 1.43)
Number of household items (range, 0-6)										1.05	*	(1.01, 1.09)	1.04	*	(1.00, 1.08)
BMI (Ref= Underweight/Normal)															
Overweight													1.24	**	(1.06, 1.45)
Obese													2.14	***	(1.81, 2.53)
Don't know/refused													1.32	***	(1.13, 1.54)

Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.001

Table 6.13. Multivariate logistic regression models of diabetes for older Mexican women by indicators of childhood health and socio-economic status (n=5877)

	Model 1 (Childhood Only)			Model 2 (Add Age, Residence, Personal Migration)			Model 3 (Add Spousal Migration to U.S. - Four Category)			Model 4 (Add Family and Adult SES Controls, Not Shown)[a]			Model 5 (Add BMI)		
2001 Childhood characteristics	OR		95% CI	OR		95% CI	OR		95% CI			95% CI			
No sanitation facilities before age 10	1.02		(0.88, 1.17)	1.06		(0.92, 1.23)	1.05		(0.90, 1.23)	0.99		(0.85, 1.17)	0.99		(0.85, 1.16)
Serious illness before age 10	1.39	**	(1.15, 1.67)	1.42	***	(1.18, 1.71)	1.40	**	(1.15, 1.70)	1.36	**	(1.12, 1.66)	1.35		(1.11, 1.65)
R has no education	1.08		(0.93, 1.26)	1.09		(0.93, 1.27)	1.13		(0.96, 1.33)	1.11		(0.94, 1.32)	1.11		(0.93, 1.31)
Mother has no education	1.16	*	(1.01, 1.35)	1.16		(0.99, 1.35)	1.11		(0.95, 1.29)	1.10		(0.94, 1.28)	1.09		(0.94, 1.28)
Don't know mother's education	1.14		(0.90, 1.43)	1.12		(0.88, 1.41)	1.07		(0.84, 1.37)	1.03		(0.80, 1.33)	1.02		(0.79, 1.31)
Demographics															
Age, years				1.00		(0.99, 1.01)	1.00		(0.99, 1.01)	1.00		(0.99 1.01)	1.01		(0.99, 1.02)
Urban residence				1.22	*	(1.05, 1.41)	1.23	**	(1.06, 1.44)	1.24	*	(1.05, 1.46)	1.24	*	(1.05, 1.47)
High out-migration state				0.79	**	(0.68, 0.92)	0.76	***	(0.65, 0.89)	0.70	***	(0.60, 0.83)	0.70	***	(0.60, 0.83)
R migrated (mostly internal)				0.95		(0.83, 1.08)	0.94		(0.82, 1.08)	0.91		(0.79, 1.05)	0.91		(0.79, 1.05)
Marital status (ref=married)															
Divorced/separated															
Widowed															
Four-category spousal migration (Ref = married, no US spouse)															
Not married, no US spouse							0.87		(0.75, 1.02)	0.89		(0.73, 1.07)	0.89		(0.74, 1.07)
Married, US spouse							1.11		(0.88, 1.39)	1.04		(0.82, 1.31)	1.03		(0.81, 1.31)
Not married, no US spouse							1.51	**	(1.15, 1.98)	1.47	*	(1.08, 1.99)	1.46	*	(1.08, 1.98)
Family Indicators															
Raised children alone										1.01		(0.85, 1.19)	1.00		(0.85, 1.19)
Number of live births										1.06	***	(1.03, 1.08)	1.05	***	(1.03, 1.08)
Total number of years married										0.99		(0.99, 1.01)	0.99		(0.99, 1.01)
Socio-economic indicators															
Domestic labor (ref = all other lifetime occupations)										1.04		(0.87, 1.24)	1.04		(0.87, 1.24)
Poor self-rated economic condition										1.47	***	(1.22, 1.78)	1.46	***	(1.21, 1.77)
Number of household items (range, 0-6)										1.06	*	(1.01, 1.12)	1.06	*	(1.01, 1.12)
BMI (Ref= Underweight/Normal)															
Overweight													1.02		(0.83, 1.25)
Obese													1.17		(0.95, 1.45)
Don't know/refused													1.12		(0.92, 1.36)

Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.001.

Table 6.14. KHB models of past-week depression, hypertension and diabetes for older Mexican women by early childhood circumstances and spousal migration history

	Depression			Hypertension			Diabetes		
	(n=5667)			(n=5556)			(n=5433)		
	OR		95% CI	OR		95% CI	OR		95% CI
No sanitation facilties before age 10									
Reduced model (without spousal migration to US)	0.29	***	(0.17, 0.42)	0.09		(-0.03, 0.21)	0.04		(-0.12, 0.20)
Full model	0.3	***	(0.17, 0.42)	0.09		(-0.04, 0.21)	0.02		(-0.13, 0.19)
Difference	<0.01		(-0.01, 0.01)	0.01		(-0.01, 0.02)	0.01		(-0.01, 0.02)
Serious illness before age 10									
Reduced model (without spousal migration to US)	0.53	***	(0.35, 0.70)	0.25	**	(0.08, 0.42)	0.25	*	(0.05, 0.46)
Full model	0.53	***	(0.35, 0.70)	0.25	**	(0.08, 0.42)	0.25	*	(0.05, 0.46)
Difference	<0.01		(-0.01, 0.01)	<0.01		(-0.01, 0.01)	<0.01		(-0.01, 0.01)
No formal education									
Reduced model (without spousal migration to US)	0.30	***	(0.18, 0.44)	-0.14		(-0.27, 0.01)	0.08		(-0.09, 0.24)
Full model	0.30	***	(0.18, 0.44)	-0.13		(-0.26, 0.06)	0.09		(-0.08, 0.26)
Difference	<0.01		(-0.01, 0.01)	-0.01		(-0.02, 0.02)	<0.01		(-0.02, 0.01)

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00. Notes: Controlling for age, residence characteristics, personal migration history, family demographics (marital status, total number of years married, number of live births, whether or not raised children alone)

Table 6.15. Multivariable logistic regression models of depression for older Mexican women by indicators of childhood health and socio-economic status (n=5989).

	Model 1 (Childhood Only)			Model 2 (Add Demographics, Migration History, Adult SES)[a]		
2001 Childhood characteristics	OR		95% CI	OR		95% CI
No sanitation facilities before age 10	1.44	***	(1.29, 1.61)	1.21	**	(1.06, 1.37)
Serious illness before age 10	1.67	***	(1.43, 1.95)	1.61	***	(1.36, 1.91)
R has no education	1.45	***	(1.29, 1.63)	1.13		(0.99, 1.30)
Mother has no education	1.18	**	(1.06, 1.32)	0.99		(0.87, 1.12)
Don't know mother's education	1.18		(0.99, 1.42)	1.02		(0.83, 1.25)
Demographics						
Age, years				1.01	*	(1.00, 1.02)
Urban residence				0.94		(0.82, 1.07)
High out-migration state				1.38	***	(1.22, 1.56)
R migrated (mostly internal)				1.12	*	(1.00, 1.26)
Four-category spousal migration (Married, no US spouse)						
Not married, no US spouse				1.25	**	(1.08, 1.45)
Married, US spouse				0.87		(0.72, 1.05)
Not married, no US spouse				1.42	**	(1.09, 1.85)
Family Indicators						
Raised children alone				1.47	***	(1.29, 1.68)
Number of live births				1.01		(0.99, 1.03)
Total number of years married				1.01	*	(1.00, 1.01)
Socio-economic indicators						
Domestic labor (ref = all other lifetime occupations)				1.24	**	(1.07, 1.42)
Poor self-rated economic condition				2.34	***	(2.02, 2.72)
Number of household items (range, 0-6)				0.92	***	(0.89, 0.96)

Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.001

Table 6.16. Multivariable linear regression models of depressive symptoms for older Mexican women by indicators of childhood health and socio-economic status (n=5989).

	Model 1 (Childhood Only)			Model 2 (Add Demographics, Migration History, Adult SES)[a]		
2001 Childhood characteristics	Coef		SE	Coef		SE
No sanitation facilities before age 10	0.58	***	(0.07)	0.29	***	(0.08)
Serious illness before age 10	0.79	***	(0.10)	0.74	***	(0.11)
R has no education	0.45	***	(0.08)	0.12		(0.09)
Mother has no education	0.34	***	(0.08)	0.08		(0.08)
Don't know mother's education	0.38	**	(0.12)	0.16		(0.13)
Demographics						
Age, years				0.01	*	<0.01
Urban residence				-0.04		(0.08)
High out-migration state				0.46	***	(0.08)
R migrated (mostly internal)				0.09		(0.07)
Four-category spousal migration (Married, no US spouse)						
Not married, no US spouse				0.33	**	(0.09)
Married, US spouse				-0.09		(0.12)
Not married, no US spouse				0.36	*	(0.17)
Family Indicators						
Raised children alone				0.49	***	(0.08)
Number of live births				0.02	*	(0.01)
Total number of years married				0.01	*	<0.01
Socio-economic indicators						
Domestic labor (ref = all other lifetime occupations)				0.31	**	(0.09)
Poor self-rated economic condition				1.13	***	(0.09)
Number of household items (range, 0-6)				-0.11	***	(0.02)
Constant	3.26	***				

Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.001

Table 6.17. Logistic regression model of diabetes for older Mexican men, with interactions between respondent's education and US migration history, (n=5475)[a]

	OR		95% CI
R has no formal education	0.74	*	(0.59, 0.94)
Return US migrant	0.82		(0.64, 1.06)
No formal education*return US migrant	1.71	*	(1.06, 2.76)

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status, and other childhood characteristics.

Table 6.18. Logistic regression model of depression for older Mexican men with interaction between childhood hunger and US migration history (n=4550)[a]

	OR		95% CI
Frequent hunger before age 10	1.93	***	(1.65, 2.25)
Return US migrant	1.31	*	(1.04, 1.65)
Frequent hunger*return US migrant	0.63	*	(0.44, 0.92)

Source: Mexican Health and Aging Study, 2003 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status, and other childhood characteristics.

Table 6.19. (Additive Interactions) Logistic regression models of hypertension for older Mexican women by spousal migration history with interactions by childhood health and socio-economic circumstances[a]

	No Sanitation Facilities (n=5972)			Serious Childhood Illness (n=5972)			No Education (n=5972)			Childhood Hunger (n=5191)[b]		
	RR		95% CI	RR		95% CI	OR					95% CI
Spousal migration to US	1.29		(0.99, 1.70)	1.09		(0.93, 1.27)	1.19	*	(1.00, 1.41)	1.24	*	(1.03, 1.50)
No sanitation facilities before age 10	1.13		(0.99, 1.28)									
No sanitation+spousal migration	1.19		(0.99, 1.44)									
Serious illness before age 10				1.20	*	(1.01, 1.43)						
Serious illness+spousal migration				1.87	**	(1.26, 2.77)						
Respondent has no formal education							0.92		(0.81, 1.06)			(0.83, 1.18)
No education+spousal migration							0.87		(0.65, 1.15)			
Frequent hunger before age 10										1.09		(0.95, 1.25)
Frequent hunger+spousal migration										1.34	*	(1.03, 1.74)

Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status, migration history, time married, number of live births, raising children alone, and childhood SES characteristics, b. for respondents who followed-up in 2003 only.

Table 6.20. (Additive Interactions) Logistic regression models of diabetes for older Mexican women by spousal migration history with interactions by childhood health and socio-economic circumstances

	No Sanitation Facilities			Serious Childhood Illness			No Education			Childhood Hunger[b]		
	(n=5920)			(n=5920)			(n=5920)			(n=5188)		
	OR		95% CI	OR		95% CI	OR					95% CI
Spousal migration to US	1.44	*	(1.03, 2.01)	1.28	*	(1.05, 1.55)	1.30	*	(1.06, 1.61)	1.09		(0.86, 1.38)
No sanitation facilities before age 10	1.07		(0.91, 1.26)									
No sanitation+spousal migration	1.27		(0.99, 1.62)									
Serious illness before age 10				1.40	**	(1.12, 1.73)						
Serious illness+spousal migration				1.62	*	(1.03, 2.53)						
Respondent has no formal education							1.11		(0.93, 1.31)			
No education+spousal migration							1.25		(0.88, 1.77)			
Frequent hunger before age 10										1.05		(0.88, 1.24)
Frequent hunger+spousal migration										1.23		(0.89, 1.69)

Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status, migration history, time married, number of live births, raising children alone, and other childhood SES characteristics, b. for respondents who followed-up in 2003 only.

Table 6.21. Four-by-four table of risk ratios of hypertension for additive interaction analysis of childhood illness and spousal migration for older Mexican women (n=5972)		
	Spouse migrated to US	
Serious childhood illness before age 10	No	Yes
No	*Ref*	1.09, NS
Yes	1.20, p<0.05	1.87, p<0.01

Source: Mexican Health and Aging Study, 2001. Controlling for age, residence characteristics and childhood and adult SES characteristics

Table 6.22. Four-by-four table of risk ratios of diabetes for additive interaction analysis of childhood illness and spousal migration for older Mexican women (n=5920)		
	Spouse migrated to US	
Serious childhood illness before age 10	No	Yes
No	*Ref*	1.28, p<0.05
Yes	1.40, p<0.01	1.62, p<0.05

Source: Mexican Health and Aging Study, 2001. Controlling for age, residence characteristics and childhood and adult SES characteristics

Table 6.23. (Additive Interactions) Logistic regression models of depression for older Mexican women by spousal migration history with interactions by childhood health and socio-economic circumstances[a]

		No Sanitation Facilities			Serious Childhood Illness			No Education			Childhood Hunger[b]		
		(n=6026)			(n=5989)			(n=5989)			(n=5204)		
		OR		95% CI	OR		95% CI	OR					95% CI
Spousal migration to US		0.86		(0.65, 1.14)	0.94		(0.80, 1.10)	0.94		(0.80, 1.12)	0.84		(0.69, 1.03)
	No sanitation facilities before age 10	1.39	***	(1.22, 1.58)									
	No sanitation+spousal migration	1.28	*	(1.05, 1.55)									
Serious illness before age 10					1.67	***	(1.40, 2.00)						
	Serious illness+spousal migration				1.39		(0.94, 2.05)						
Respondent has no formal education								1.42	***	(1.25, 1.61)			
	No education+spousal migration							1.24		(0.93, 1.64)			
Frequent hunger before age 10											2.22	***	(1.93, 2.55)
	Frequent hunger+spousal migration										1.69	***	(1.30, 2.21)

Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status, migration history, time married, number of live births, raising children alone, and other childhood SES characteristics, b. for respondents who followed-up in 2003 only.

Table 6.24. (Multiplicative Interactions) Logistic regression models of later-life health outcomes by childhood sanitation facilities and spousal US Migration for older Mexican women.

	Depressed			Hypertension			Diabetes		
	(n=6015)			(n=5903)			(n=5910)		
	OR		95% CI	OR		95% CI	OR		95% CI
Spousal migration to US									
Married, spouse to US	1.12		(0.90, 1.39)	0.95		(0.77, 1.17)	0.99		(0.75, 1.30)
Not married, no spouse to US	0.76		(0.53, 1.09)	0.98		(0.69, 1.37)	0.97		(0.61, 1.55)
Not married, no spouse to US	1.21		(0.77, 1.91)	2.02	**	(1.27, 3.22)	2.36	**	(1.44, 3.84)
No sanitation facilities before age 10	1.26	**	(1.07, 1.48)	1.12		(0.96, 1.31)	1.13		(0.92, 1.39)
No sanitation*married/spouse to US	1.25		(0.98, 1.60)	0.98		(0.77, 1.25)	0.83		(0.69, 1.14)
No sanitation*not married/no spouse to US	1.16		(0.77, 1.77)	1.05		(0.70, 1.56)	1.11		(0.65, 1.89)
No sanitation*not married/spouse to US	1.22		(0.73, 2.06)	0.51	*	(0.30, 0.87)	0.50	*	(0.28, 0.89)
Overall F-Test for Interaction Term	3.42		p=0.33	6.31		p=0.10	6.67		p=0.08

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status, migration history, time married, number of live births, raising children alone, and other childhood SES characteristics.

Chapter 7: Discussion

7.1 Summary of Findings

To review, the purpose of this dissertation was to answer the following questions:

1. **What is the influence of previous personal and spousal migration to the U.S. on later-life diabetes, hypertension, and depression outcomes for middle-aged and older Mexican adults living in Mexico?**

2. **How does migration history, including family migration history, change the relationship between early childhood socio-economic and health conditions and later-life chronic disease and depression for middle-aged and older adults in Mexico?**

The answer to the first question appears to be contingent on whether migration is personal or spousal and on which health outcome is modeled. My findings suggest no significant association between U.S. migration and any of the three later-life health outcomes I test for older men in Mexico, regardless of how US migration is specified (e.g. binary, differentiating by cumulative time abroad, and so on). On the other hand, spousal migration to the U.S. does appear to have a significant association with later-life hypertension and diabetes for older Mexican women, but not with depression. These results related to spousal migration are also contingent on current marital status: there is only a significant association between spousal migration to the US and later-life health for female respondents who were divorced, separated, or widowed at the time of the survey.

These findings complicate the theoretical perspectives that I used to frame these analyses, which led to my hypotheses that personal and spousal migration to the U.S. would each be significantly associated with worse later-life health outcomes. In particular, I drew on the cross-national framework for immigrant health, which emphasizes the importance of understanding socio-economic determinants of health, cross-border social networks, and components of the life-course perspective in framing health research on migrants and their family members (Acevedo-Garcia et al., 2012). I made an explicit link between personal U.S. migration experiences and socio-economic determinants of health, suggesting that there may be both social and economic risks and resources associated with U.S. migration. I expected that discrimination, occupational exploitation, poor material conditions, and poor access to health care experienced in the U.S. might have a persistent and adverse effect on later-life health – an effect I found no evidence of in my analysis, at least in the case of later-life depression, hypertension, and diabetes. I additionally expected that adverse effects of U.S. migration would be greater for those who spent more cumulative time abroad, which was also not supported.

I anticipated that there would be countervailing effects of U.S. migration for return migrants living in Mexico in middle and older-age that might contribute to better health outcomes, or at least mitigate some of the adverse effects of U.S. migration experience. I concentrated in particular on the potential benefits of upward socio-economic mobility that U.S. migrants might experience, since I expected that return U.S. migrants would be selected from relatively socio-economic disadvantaged pre-migration statuses and make significant gains in social and economic standing in their communities of origin, which would yield better access to health care, and have positive psycho-social effects that would mitigate the strain of U.S. migration (Alarcón, 1988; López Castro, 1986; V.N. Salgado de Snyder, 2007). I did find descriptive evidence of this socio-economic mobility for return U.S. migrants, who on average experienced greater socio-economic disadvantage during childhood (e.g. less likely to have household sanitation facilities or any formal education), but little observable difference in economic indicators at the time of the survey compared to their non-U.S. migrant counterparts, including a self-rated measure of financial situation, and indicators of household items, household wealth, and monthly income. It may be that the countervailing effects of U.S. migration, both negative and positive, for those who returned to Mexico were powerful enough to cancel out a significant association between US migration and health in either direction.

But I did find some evidence for the idea that the effect of U.S. migration on later-life health depends on socio-economic status. Specifically, being a return U.S. migrant status in combination with poor self-rated economic status was associated with increased risk of later-life depression and hypertension compared with a reference group of non-U.S. migrants with relatively good self-rated economic status. Return U.S. migrants who considered themselves to be relatively well off economically did not have a significantly different risk of later-life depression or hypertension compared to their subjectively well-off counterparts with no U.S. migration experience. That is, the effects of U.S. migration on depression, hypertension, and diabetes, at least for this cohort of middle-aged and older Mexicans, appeared to be null if they felt they were meeting their basic needs. But the evidence suggests that return U.S. migrants who not achieve a sense of economic well-being, or at least maintain it until middle or older age, appear to be at risk for later-life depression and hypertension. There were similar interaction patterns between U.S. migration and wealth and income, respectively, for depression only.

The life-course concept of ‘trajectories’ might be useful to understand the intersection of return migration, socio-economic status and health. That is, life-course theory suggests that there are trajectories, or pathways, of work, education, and family that shape behavior and health outcomes. These trajectories are shaped by a combination of individual-level factors, but also by broader social and historical factors that are specific to a given birth cohort. But even within the same birth cohorts of older Mexican men, normative socio-economic trajectories might diverge based on U.S. migration experience. In fact, the cross-national framework for immigrant health assumes that social trajectories diverge for immigrants relative to non-immigrants who remain in sending countries (Acevedo-Garcia et al., 2012). And descriptive statistics for the MHAS sample and qualitative literature elsewhere do suggest that the normative socio-economic trajectory may in fact be different for return U.S. migrant men compared to their non-migrant counterparts, characterized by upward socio-economic mobility from childhood to adulthood.

It is possible that there are adverse social consequences associated with failure to conform to this normative socio-economic trajectory. For example, in his qualitative research on Mexican families in the 1960s, Wiest reports that migrant men's failure to send sufficient remittances was a risk factor for marital dissolution. Hondagneu-Sotelo points to the pressures around economic attainment that U.S. migrant men in particular might face, stating that "[p]atriarchy allows men to depart, but it also mandates that men serve as good financial providers for their families" (Hondagneu-Sotelo, 1994, p. 188). There may be adverse health consequences associated with failing to meet these expectations, including mental health consequences of reduced self-worth. This lends support to the idea that the effects of migration on health need to be understood in the context of other socio-economic determinants of health.

On the other hand, the 'failure' to conform to a trajectory of socio-economic well-being appears to be a risk factor for depression and hypertension for both return U.S. migrant men and their older male counterparts with no personal U.S. migration experience, suggesting that normative socio-economic trajectories for men converge by later life. That is, while U.S. migrant men might have been expected to follow a trajectory of rapid socio-economic advancement, the meaning of socio-economic disadvantage for late-life health appears to be the same for U.S. migrant and non-U.S. migrant men (Hertzman & Boyce, 2010). Socio-economic status in both childhood and late-life is a risk factor for mental and physical health for both groups by potentially contributing to social stress, reduced psychological resources for coping with stress, such as mastery or personal control (Kahn & Pearlin, 2006), increased propensity for health risk behaviors, and less engagement with preventive health care and health behaviors for men in particular (Courtenay, 2000). These findings complicate the assumption of divergent SES and health trajectories for migrants and non-migrants as suggested by the cross-national framework, at least in the case of migrants who have returned to their sending countries – the cross-national framework is mostly silent about this population.

My analysis of spousal migration and later-life health for older Mexican women was in part a function of the limited cases of return U.S. migrant women in the MHAS sample. But it also a responded in part to the need to understand the effect of cross-border social ties in the study of immigrant health, including the effects of international migration on the health of family members who themselves may be international or internal migrants, or who may stay in households and communities of origin. My finding that the effect of spousal migration to the U.S.—an experience that generally occurred much earlier in the life-course for this group of middle-aged and older adults—depended on their *current* marital status, suggests that the effects of cross-border separation needs to be understood in the context of current family configurations.

It is important to emphasize that I do not know the timing of spousal migration to the U.S. relative to marital dissolution or widowhood, although mean values across the sample suggest that spousal migration to the U.S. likely happened well before the end of marriage. Also, widowhood presumably was not related to spousal migration to the U.S. in the majority of cases, although spousal migration to the U.S. was significantly associated with greater odds of later-life hypertension and diabetes for the sample of widowed Mexican women in similar ways as the divorced/separated group. Whether or not divorce, separation, or widowhood was the result of spousal migration to the U.S. – the realization of the worst fears and anxieties expressed by women who stay (Dinerman, 1982; McGuire & Martin, 2007; McKenzie & Menjívar, 2011) – spousal migration was a robust predictor of later-life hypertension and diabetes for this group.

Questions remain as to what explains this significant association. The significant association between spousal migration and later-life hypertension and diabetes for women not in a union was not explained by the additional burden of raising children alone. Although women who reported both spousal migration to the U.S. and were not currently in a union had the highest rates of solo child-rearing (65% compared to 13% of women still married at the time of the survey whose spouses never migrated to the U.S.), and raising children alone was a significant predictor of later-life depression and hypertension, it was not a significant mediator of the relationship between spousal migration and health.

Other studies on women who stay behind in Mexico while their spouses migrate suggest that women do face the prospect of working outside the home to support the survival of the family, particularly as they wait for their spouses to establish themselves in the U.S. (Aysa & Massey, 2004; Dinerman, 1978; Mummert, 1988). Stressors related to this increased burden could potentially explain some of the adverse effect of spousal migration. Nevertheless, increased burden of working outside the home, or working in the domestic sector, did not explain the association between spousal migration and later-life hypertension or diabetes. The descriptive findings for the MHAS sample suggest that regardless of husbands' U.S. migration status, those who were not married at the time of the survey were the most likely to report a history of working outside the home. Women whose spouses migrated to the U.S. and remained married were the *least* likely to reporting working outside the home, at least when they were in middle-age and older adulthood to report retrospectively on their work history. I was not able to assess whether or not women received remittances from their spouses, which might account for some of the effect of spousal migration to the U.S. on later-life health. A recent study of non-migrants in Albania found increased risk of coronary heart disease among women whose spouses migrated abroad, but only if those women were not receiving remittances (Burazeri et al., 2007). Differences in body mass index, a proxy for health behaviors related to chronic disease outcomes in my analysis, also did not explain the association between spousal migration and later-life hypertension and diabetes for non-married women.[54]

Another surprising finding given the psycho-social effects of spousal migration described by qualitative literature was that there was no significant association between spousal migration to the U.S. and depression; current marital status was a more important predictor. The findings here might have been different if the outcome was *lifetime* depression. Given that spousal migration likely occurred in the distant past, it may not resonate with past-week depressive symptoms in mid-life and older adulthood. On the other hand, the significant results for hypertension and diabetes may be picking up on effects of chronic stress due to spousal

[54] Lack of remittances has been cited as a reason for marital dissolution in Mexico, which further convolutes the causal ordering between marital dissolution, women's labor and socio-economic status, and later-life health (Wiest, 1983).

migration and marital dissolution, as well as increased burden for work in and outside the home, that accumulated earlier in the life-course to produce adverse effects on chronic disease. There is no detailed information about the onset of hypertension or diabetes, and it may be that women were diagnosed with these conditions far before the baseline survey, such that these conditions were more sensitive to stressors in early and mid-adulthood.

The findings for the effects of personal US migration on the health of men and spousal migration to the U.S. on the health of women should be understood within the broader literature on the gendered effects of U.S. migration. Scholars on gender and migration suggest that studies of the effect of migration consider the dynamic and perpetually re-negotiated set of gender roles and norms, and the unequal distribution of resources and risks for men and women (Mummert, 2012; Parrado & Flippen, 2005). For example, qualitative studies suggest that Mexican women have historically had little say in migration decision-making, but have been critical to supporting the enterprise of U.S. migration once its undertaken (Dinerman, 1978; Hondagneu-Sotelo, 1994).

My findings cannot speak to all of the dynamic shifts around gender and migration, owing in part to the ambiguous timing of spousal U.S. migration, labor histories, and feelings about decision-making abilities for this sample of older Mexican women. However, there may be some evidence of some gender inequality in the health effects of U.S. migration, given the estimations of greater odds of later-life diabetes and hypertension for a group of middle-aged and older Mexican women who experienced both spousal migration to the U.S. and marital dissolution. In contrast, older Mexican men did not appear to be adversely affected by their own U.S. migration. Despite their critical role in the U.S. migration of spouses and other family members, non-migrant women who stay may suffer more adverse health consequences the result of their migration in some cases. These negative effects for women who were formerly in a union with a U.S. migrant seem to persist even as they reach middle age or older adulthood, and as women in Mexico overall tend to have fewer financial resources to support their health and healthcare later in life (V. N. Salgado de Snyder & Wong, 2007).

On the other hand, women who stayed did not appear to be uniformly vulnerable to adverse health consequences of U.S. migration. For women who stay in Mexico, the U.S. migration of their spouses may enable women's empowerment through increased civic engagement, control over earnings, and decision-making power. For one, women who remained married or in a union with their U.S. migrant spouses by the time of the MHAS survey appeared to have similar health profiles as their counterparts whose spouses did not migrate to the U.S. In addition, the results of interaction effects between spousal migration to the U.S. and indicators of women's own labor, migration and decision-making power point both to the idea that women's own experiences in these dimensions can influence the effects of spousal migration to the U.S. on later-life health. Women's own migration internally within Mexico also seemed to mitigate some of the adverse health effects of spousal migration to the U.S., which points to the importance of considering women's own migration histories when estimating the effects of spousal migration. This sample of women reported a high rate of internal migration at some point in their lifetime, a finding that reflects the fact that labor migration within Mexico was not unusual for this cohort of women in Mexico, who may have engaged in domestic or factory labor earlier in life to support rural households (Arizpe, 1982). They have long migrated to the U.S., although in smaller numbers than men for the cohorts represented by the MHAS sample (Guendelman, 1987; Mummert, 1988; J. Reichert & Massey, 1980).[55]

There was also a significant interaction term between spousal migration and women's current decision-making within the family, whereby spousal migration and having less decision-making power relative to one's spouse was associated with elevated odds of hypertension. This underscores the importance of considering the effects of spousal migration in the context of other aspects of women's power (Parrado & Flippen, 2005). Additionally, there was no significant difference in the percentage of married women who report having equal or greater decision-making power relative to their spouses by whether or not their spouses migrated to the U.S. or not, which reflects Mummert's assertion that "empowerment is not a guaranteed byproduct of the migration experience" for Mexican women, at least later in life (2012, p. 43). And although I am skeptical about the usefulness of the scale of mastery for predicting health outcomes because of the low reliability of the overall scale and its limited predictive power in models of health outcomes, mean scores of mastery or personal locus of control were similar across all women by marital status and spousal migration to the U.S.

[55] The MHAS sample unfortunately does not capture the full U.S. migration experience of Mexican women, particularly for later cohorts of women who migrated themselves to the U.S. with family members and autonomously (Kanaiaupuni, 1995). Samples that include later Mexican birth cohorts *might* capture more US return migrant women who could provide the basis for more direct comparison of the association between return U.S. migrant status and health for Mexican men and women. On the other hand, analyses of migration and health for a younger sample of respondents to the Mexican Migration Project also correspond to the divide of personal migration for men, spousal migration for women (Ullmann, 2012; Ullmann et al., 2011).

The implications of my findings for the health influences of cross-border social ties on later-life health extend beyond the effects of spousal migration to the US, and imply that the adverse health effects of being 'left behind' may extend to both men and women. In supplemental analyses of the effects of other family member migration to the U.S., I found a significant association between parental and/or sibling migration to the U.S. and greater odds of later-life depression and hypertension for men who never migrated to the U.S. Parent or sibling migration to the US and having at least one adult child living in the U.S. was significantly associated with greater odds of later-life depression for older Mexican women. Having an adult child living in the US was significantly associated with greater odds of hypertension for women not in a union at the time of the survey, even when controlling for spousal U.S. migration and other demographic, family, and socio-economic covariates.

While these analyses were somewhat limited relative to my extensive inquiry into the effects of personal and spousal migration to the U.S., they underscore the importance of understanding the complete migrant family, including the dynamics of marital status, and the US migration of parents and siblings and adult children, in analyses of migration and health. This focus on family member migration to the U.S. and later-life health for older Mexican adults integrates cross-border social ties with the life-course construct of *linked lives*. That is, the individual life-course is influenced by life trajectories and transition of others, including the movement of these others across international borders (Jasso, 2003). It is possible that the U.S. migration of family members represents a turning point for social trajectories of those who remain in countries of origin – prompting them to enter the labor market when they had not done so before, for example, or causing a shift in their role in the family. These shifts might have mixed effects on health outcomes for those who stay behind. For example, there was a significant association between having least one adult child living in the U.S. and poorer later-life physical and mental health for older Mexican women. But there are also likely countervailing health benefits of adult child migration to the U.S. – most notably through remittances that enable access to health care for disease prevention and treatment and mitigate the loss of income that comes with retirement for many who labored outside the formal sector in Mexico (Amuedo-Dorantes & Juarez, 2012; Salinas, 2008). In some cases, the U.S. migration of adult children and other family members might be considered a normative life transition for those who stay behind, with potential benefits in cases where such transitions are successful, and adverse social and health consequences in the event of a 'failed' transition to U.S. migration. These multiple layers of U.S. migration experience might be best studied in future research in a multi-level framework that takes into account both the migration of individuals and their family networks.

The answer to the second central question behind my dissertation research appears to be slightly more straightforward. That is, there is limited evidence that US migration experience, including the U.S. migration of spouses, changes the relationship between early life conditions and later-life health. Although I do find some evidence of significant additive interactions between spousal migration to the U.S. and later-life health early life indicators and US spousal migration experience in particular, it is generally one in which spousal migration experience exacerbates the adverse effects of early childhood adversity on later-life health. This may underscore the idea that women might be doubly vulnerable to childhood disadvantage and spousal migration to the U.S. in young and mid-adulthood, with adverse effects on later-life health.

The childhood conditions I used in this analysis appear to have latent effects on later-life health conditions that are in part direct, or unmediated by later-life conditions. Some of the effects of childhood conditions on later-life health did appear to be indirect, or mediated by later-life socio-economic conditions, for example. However, there was no evidence that U.S. migration was one of the mediators of this life-course relationship between early-life indicators and later-life depression, diabetes, and hypertension. That is, even though childhood socio-economic and health disadvantage is to some degree associated with both personal and spousal migration to the U.S., U.S. migration does not appear to account for the pathway through which early life conditions affect later-life health.

There were two potential exceptions to the idea that U.S. migration might disrupt the life-course trajectory linking early life conditions and later-life health, with the findings of a flipped social gradient in diabetes for return U.S. migrant men as compared to their non-U.S. migrant counterparts, and the significant buffering effect that U.S. migration had on the relationship between childhood hunger and later-life depression. These results lend some support to the idea that U.S. migration might serve as turning point in the life-course trajectories of socio-economic status and health, with the capacity to alter the long reach of early-life conditions on later-life health.

Despite the compelling nature of these two findings, they should be viewed with some skepticism given the fact that few significant interaction effects were observed across dozens of models. The finding that there was mostly no significant interaction between indicators of early-life socio-economic and health conditions and U.S. migration experience in models of later-life health – but significant main effects of greater childhood adversity on greater odds of later-life depression, hypertension, and diabetes – lends support to the idea that childhood is a critical period for establishing health across the entire life-course (Hertzman & Boyce, 2010). These childhood conditions may become biologically 'embedded' such that they permanently alter trajectories of health and well-being. For example, relatively low social position within school environments or communities has been linked to heightened stress responses in early childhood, which might have lasting consequences for how socially disadvantaged indivduals respond to stress across the life-course (e.g. with elevated cardiovascular and adreno-coritsol responses) .

Even if U.S. migration allows for changes in social and economic conditions, to family configurations, or to health behavior profiles as suggested by my descriptive findings for men in particular, these changes might not be enough to completely alter the life-course trajectory of socio-economic disadvantage and health. This supports the idea of increased integration of the life-course perspective in studies of migration and health, including a binational perspective on early-life experiences in migrants' countries of origin, and how these factors might influence health long after international migration including return migration, and the migration of family members (Acevedo-Garcia et al., 2012). However, there is a tension between the assumption of divergent social and health trajectories for migrants and non-migrants, and the lasting effects of early life socio-economic status on later-life health, regardless of migration experience. While both are possible simultaneously, I find stronger evidence of the embedded nature of childhood disadvantage, and less for diverging health trajectories for migrants and non-migrants, at least in the case of those who are living in Mexico later in life.

Overall, the findings from my dissertation reports on social determinants of health at the intersection of life-course socio-economic status, gender, and the configurations of family networks across the U.S.-Mexico border for older adults. The middle-aged and older adults in my sample generally experienced poor material conditions, low levels of education, and high levels of under-nutrition during their early life. These experiences continue to be significantly associated with later life health, corroborating the growing body of research on the 'long arm' of life-course socio-economic status on later-life health in Latin America. This relationship does not appear to be significantly altered by experiences related to U.S. migration for this sample. And those who were most disadvantaged during childhood have continued to live with conditions of economic inequality and a limited safety net for older adults with no formal work history (Wong & Palloni, 2009).

It also appears that the adverse effects of family member migration to the U.S. might reach far into older adulthood, with important differences by gender. Women whose spouses migrated to the U.S. and are no longer in a union appear to be particularly impacted by the effects of spousal migration. In fact, early life disadvantage and spousal migration to the U.S. in some cases combined to present an even greater risk for the later-life health of older Mexican women in this sample. This points to how disadvantage across multiple axes of power and privilege, including gender, mobility, and socio-economic status (Mahler & Pessar, 2001) might have a lasting impact on chronic disease, although the question of mechanisms driving this relationship remains largely open.

These findings contribute to emerging theory linking immigrant health to a life-course perspective by highlighting a tension between the embedded nature of early-life experiences and the possibility that U.S. migration experiences contribute to shifts in social trajectories. Most of immigrant health theory and research to date has indirectly assumed that international migration represents a turning point so dramatic that early-life experiences are no longer worth studying (i.e. the container model). Most of the theoretical literature on the life-course, on the other hand, assumes a somewhat uniform influences on the social and health trajectories for a given birth cohort, rather than considering divergences within a birth cohort based on their experiences with international migration (Elder et al., 2003; Silverstein & Giarrusso, 2011). This literature conceives of a single 'society' that individuals age and develop in along the life-course (Hertzman & Boyce, 2010). This may be due to the development of life-course theory in the West, but is insufficient for the study of health and aging in Mexico, where life-course influences of U.S. migration should be considered alongside the Mexican context, even for those who never migrate to the U.S.

7.2 Study Limitations

I have already mentioned a number of limitations specific to each results chapter. Most important is the ambiguity of timing of spousal and other family member migration relative to the onset of respondents' health conditions, and relative to other key life-course events. It is difficult to establish the causal influence of family member migration on the later-life health of older adults, for example, since it is impossible to tell if U.S. migration of parents or siblings was a characteristic of respondents' childhood (e.g. family separation) or later along the life-course. Similarly, it is impossible to tell whether measures of women's labor and power are changed by the migration of their U.S. spouses (or their own internal migration), given that the timing of labor and internal migration are ambiguous relative to the migration of spouses and other family members. Here I review a number of additional limitations to the study approach and data overall.

To begin with, there are a number of limitations to the propensity score approach. One of the primary challenges of this approach is properly estimating the propensity scores, which again assume that predictors of entry into treatment are observed. This is potentially an issue in the example of testing for selection bias among women whose spouses migrate versus women whose spouses do not migrate. Since I do not have a measure of pre-spousal migration relationship control, I am still left with a potential endogeneity problem, whereby spousal migration decisions are made in part based on variation in relative decision-making power within marital relationships (Parrado et al., 2005).

While I do have a large number of predictors for my propensity score model of personal U.S. migration, including early-life health and socio-economic status, and family migration history, there are likely some unobserved predictors of migration that I am missing in my analysis that might continue to cause an endogeneity problem given unobserved heterogeneity in migration selection. For example, individuals with greater pre-migration tolerance for risk might be more likely to migrate, all else equal. This individual personality trait may also relate to later-life health outcomes, if those with greater tolerance for risk are also more likely to engage in risky health behaviors (e.g. substance use or risky sex). This could lead to an overestimation of the association between U.S. migration experience and worse later-life health outcomes, given potential migration selection on personal risk tolerance. The opposite could also occur, whereby migration selection on unobserved individual attributes like greater physical ability, which could positively influence later-life health outcomes, might lead to an underestimate of the association between U.S. migration experience and later-life health.

There are at least two other methods that would theoretically do a better job at addressing selection bias on unobserved characteristics. One, instrumental variable analysis, involves the identification of one or more ‘instrumental’ variables that are expected to be uncorrelated with the outcome, but correlated with the predictor or ‘treatment’ variable. The co-variation between the exogenous instrumental variable and the ‘treatment’ is then used to predict outcomes. This approach yields local average treatment effects for those who might have received the treatment under different scenarios of the exogenous, instrumental variable. I was not able to identify suitable instrumental variables for this analysis. In particular, respondents’ place of birth is mostly unknown in the sample, which precludes the use of state-specific measures of historic migration rates, infrastructure, or environmental ‘shocks’ as exogenous, pre-migration predictors with any kind of geographical specificity (Hanson & Woodruff, 2003). In addition to the challenge of finding an appropriate instrumental variable, findings from instrumental variable analysis often have very limited interpretation. Specifically, instrumental variable analyses produce only ‘local average treatment effects’, or the effects of some ‘treatment’ for marginal cases that would be selected into treatment given a change in the instrumental, exogenous variable (e.g. for individuals who might have been selected into migration given some environmental shock, or different historic migration rates) (Morgan & Winship, 2007).

Another method for assessing the causal relationship between migration and health outcomes uses fixed-effects models in studies that capture respondents pre and post-migration

(Creighton et al., 2011; Nobles et al., 2014; Rubalcava et al., 2008). With this kind of pre and post-method, researchers use fixed effects models that account for unobserved heterogeneity on time invariant factors. However, very few respondents to the Mexican Health and Aging Study (MHAS) migrated between the 2001 and 2003 study waves, making this kind of analysis impossible. Migration in the MHAS study occurred for the most part before the baseline survey in 2001, although many completed their last migration in 2000. For that reason, migration experience is analytically a time-invariant, baseline characteristic. Using a fixed effects model of change in health due to migration would "difference out" time-invariant factors like baseline migration history, making this an unsuitable approach for use with the MHAS sample. In theory, I could also use fixed or random effects measures to control for household, community, or state-level differences in time-invariant and time-varying measures within a single study wave, or over time. However, I do not have detailed information about communities or states in which respondents live, either at the time of the study or pre-migration, and I have information on other household members only for respondents whose spouses also responded to the survey.

There is also a return migration selection bias present in my analysis and important for my interpretation of data, which I was not able to directly address in my dissertation. That is, return migrants represent a non-random sub-group of overall Mexican migrants to the U.S. (Masferrer & Roberts, 2012; D. S. Massey, 1987). While I am limited in addressing this problem empirically, I note that my findings related to return migrant health outcomes should be viewed in the context of this selection bias. A glance at the reasons for return provided by the return migrant sample suggests that there is little variation in the self-reported motivations for return; nearly all return migrants report returning because they missed their families. Given that the motivation for return is not overwhelmingly health related, it seems plausible that if I found any health effects of return migration, they would not necessarily be because the return migrants are more likely to have health problems in the U.S., which prompts a return back to Mexico.

As indicated previously, there are several limitations to the doctor-diagnosed indicators of diabetes and hypertension. In particular, knowledge of these measures depends on having had tests completed for these kinds of health outcomes. Many MHAS respondents report limited recent testing for diabetes and hypertension, and many lacked a usual source of medical care and health insurance at the time of the survey. I assessed in part the degree of bias in Appendix B, and the degree to which that bias might be influencing my results and do not find any evidence that my results are skewed by testing behavior or access to care. However, more "objective" measures of diabetes and hypertension through clinical tests blood tests and repeated measures of blood pressure alongside the self-reports might increase my confidence that respondents who say they do not have these chronic conditions actually do not. While these kinds of measures will be made available with the most recent collection of MHAS data that includes biomarker data (measured versus just self report), they were tested for only a sub-sample of respondents, and I was not able to use them as part of my analysis.

There are limitations to keep in mind for the self-report measure of depressive symptoms as well. In particular, I am unable to assess age of onset of depressive symptoms. In Mexico, the average age of onset of any clinical mental health disorder has been estimated at 21 years old (Medina-Mora et al., 2007). Cases of early onset depression may have different etiological pathways compared to cases of onset in older adulthood (Myers & Hwang, 2004). For example, early onset of depressive symptoms may relate more to stressful family conditions during childhood and adolescence, as well as family history of mental illness. Onset of depressive symptoms in older adulthood may relate more directly to current life stresses, including financial and social-status stresses, or to current health conditions.

Given the early age of onset for depressive symptoms in particular, it may be that the relationship between adult SES and depressive symptoms is reverse, whereby those with increased depressive symptoms have reduced socio-economic status due to more limited occupational opportunities or an inability to work, and a subsequent decline in financial assets (Krause, 1999). The process of health selection may certainly be at work, although it is not clear that health selection would account entirely for the disparity in depressive symptoms by SES measures. For example, in a longitudinal study of British adults, Stansfield et al. (2011) found support for both social causation and health selection hypotheses in the link between childhood socio-economic position and depressive or anxiety disorder in mid-life. In research using the full 11-year panel of MHAS data Torres, Rizzo and Wong (Torres, Rizzo, & Wong, 2014) found that socio-economic disparities in depressive symptom persisted as respondents aged, even when accounting for attrition biases due to mortality and loss to follow-up.

The final limitations relates to translating these findings to public health efforts for chronic disease and depression outcomes for middle-aged and older adults in Mexico, given the observation that the prevalence of diabetes, hypertension, and depression, and the availability of medical care for these conditions varies widely by Mexican state (Belló et al., 2005). I have only broad measures of residence, including urban versus rural and high out-migration state versus other state and not actual state of residence identifiers. Nevertheless, while there is great variation in chronic disease and depression outcomes by state in Mexico, the rural/urban divide remains an important distinction in terms of epidemiological profile, access to health care and health insurance coverage, and other social and economic determinants of health.

7.3 Strengths

Despite the limitations, my dissertation responds to important questions at the intersection of aging, epidemiologic change, and the role of U.S. migration in the health of middle-aged and older Mexican adults. My dissertation pays attention to three issues that have received limited attention in the growing literature in the topics of aging, migration, and health outcomes in Mexico. For one, in my analysis of the role of U.S. return migration and later life health, I address emigration selection bias, albeit with the limitations that I describe above. Emigration selection bias has either not been addressed, or has been addressed with very limited pre-migration measures in other estimating the health outcomes for return migrants compared to non-migrants (Ullmann et al., 2011; Wong & Gonzalez-Gonzalez, 2010). In addition, I am examining the ways in which socio-economic status, including measures of wealth and income, but also subjective socio-economic status indicators may condition the relationship between U.S. migration experience and later-life health.

Secondly, I have addressed the effects of spousal migration to the U.S. on later life health. This contribution extends the qualitative and community-level quantitative literature on mental health impacts of spousal migration to include a nationally representative sample of older adults and to include chronic disease outcomes. Finally, I am examining the impact of migration in the context of other life-course contributors to later-life health outcomes. Studies of early-life influences on later-life health and studies of immigrant health in both the U.S. and Mexico have generally been carried out separately.

7.4 Policy Implications

My findings should be viewed in the context of recent policy changes for older adults in Mexico, as well as families living in poverty that may include older adult members. For example, health reform in Mexico has sought to expand health insurance coverage to all Mexicans with the intention of reducing catastrophic health expenditures, particularly for families with older adult members (Knaul, Arreola-Ornelas, Méndez-Carniado, & Torres, 2007; Knaul et al., 2012). The *70 y más* program has aimed to provide a pension to many of Mexico's older adults who do not receive any income in retirement (Amuedo-Dorantes & Juarez, 2012). And there is evidence that long-standing conditional cash transfer policies for families in Mexico may have trickle-down effects on the health of older Mexican adults living with extended families (Behrman & Parker, 2013). These policies have had mixed effects on health status, access to care, and the broader economic conditions of older adults in Mexico. Despite policy efforts towards better health care and poverty reduction, challenges remain related to access to health care and out of pocket costs of care, particularly for families with older adults and those living in rural areas of Mexico (Knaul et al., 2007). Efforts at poverty reduction in older adulthood also appear to be tempered by some parallel decreases in private transfers from family members to older adults with limited incomes (Amuedo-Dorantes & Juarez, 2012). Nevertheless, programs that strive to reduce poverty across life-course may have positive long-term impacts on chronic disease and depression outcomes as individuals age in Mexico (Behrman & Parker, 2013).

My dissertation research highlights a couple of points relevant to these policies that affect older adults in Mexico. For one, although the results from the analysis of return U.S. migration on the health of older Mexican men does not point to return U.S. migrants as a particularly vulnerable group, either in terms of later-life poverty or health, this group of return migrants is significantly less likely to have health insurance coverage, which leaves them vulnerable to high out-of-pocket costs, including catastrophic medication that could change their socio-economic conditions in the case of a major medical event. This would be a group to watch in greater detail when examining the effects of health reform in Mexico, as is made possible with the most recent (2012) wave of the MHAS, to see if coverage rates increase. A recent analysis of 2010 Mexican Census data suggests that return U.S. migrants to Mexico continue to face lower rates of health insurance coverage despite expanded coverage through *Seguro Popular* (Wassink, 2014). While return U.S. migrants are more likely to have other migrant family members, including adult children in the U.S., who might be better equipped to help support them financial and with medical equipment (Amuedo-Dorantes & Juarez, 2012; Salinas, 2008), in the absence of these informal safety nets, they might stand to gain a great deal from health reform given low rates of health insurance coverage.

On the other hand, my analysis of the effects of spousal migration to the U.S. suggest that women who report both spousal migration to the U.S. and are currently not in a union might be a particularly vulnerable group that might be targeted specifically by health-related interventions, even if this group mostly lives with other family members that might provide emotional and financial support, as well as caregiving assistance. In fact, the descriptive statistics suggest that women who report spousal migration to the U.S. appear to be relatively well off economically, regardless of whether they are in a union at the time of the survey. This may be related to economic benefits of their spouses' migration, remittances that might be provided by their adult children living in the U.S., or their own labor outside the home. This group also appears to be covered by health insurance coverage and reports similar access to health care as other groups of women by marital status and spousal migration to the U.S. as of 2001, but nevertheless has worse outcomes in terms of hypertension and diabetes. This suggests that women who report spousal migration to the U.S. and marital dissolution later in life might not need to be targeted in particular as part of new health and social policies, but might need additional attention by medical providers in terms of screening and prevention for chronic diseases.

The final chapter on the effect of early life conditions on later-life health also points to a group of older Mexican adults that might be particularly vulnerable to poor health outcomes later in life. This chapter suggests that even major life events like U.S. migration or the U.S. migration of family members does little to moderate or change the relationship between early-life indicators and later-life health. When there is a change, it is often in the direction of exacerbating the adverse effects of early-life socio-economic and health disadvantage. As stated previously, these results suggest that early-life conditions persist in their influence on later-life health. This means that older adults who experienced the highest levels of early-life disadvantage might be at particular risk for poorer health outcomes later in life. But this also suggests that health and economic policies should continue to target individuals along the entire life-course, given that investments in education, improvement of material conditions and health during early life will resonate in older adulthood.

7.5 Plans for Future Research

The most promising line of inquiry to emerge from my dissertation relates to the effects of family member migration the U.S. on the later-life health of older Mexican adults, and the effects of spousal migration in particular for women who were not in a union at the time of the survey. There are at least two opportunities to advance this research within the context of the

Mexican Health and Aging Study. One would be to examine the effect of spousal migration to the U.S. on changes to health over time. My analyses of spousal migration to the U.S. and depressive symptoms in 2003 using a lagged-dependent variable approach is an initial step in this longitudinal research, albeit with null results. There is the potential to utilize the most recent wave of the MHAS, conducted in 2012, to see if there is an association between spousal migration to the U.S. and changes across multiple health outcomes, including physical functioning, disability, or the onset of new chronic diseases over an 11-year study period.

The benefit of this kind of analysis over a long period of time is that I would be able to assess the relative effects of spousal U.S. migration and marital status in a more dynamic way. While few spouses migrated to the U.S. across the panel waves, there was significant change in marital status. Since these shifts in marital dissolution after the baseline survey had presumably little to do with spousal migration to the U.S. for this group of older adults, I could get further at teasing apart effects of more recent marital dissolution versus the effects of marital dissolution earlier in the life-course, *potentially* related to spousal migration to the U.S. The drawback to this analysis of panel data is the significant attrition of the study population over such a long period. A total of 487 respondents who reported spousal migration to the U.S. completed follow up interviews in 2012, which breaks down to 336 who were married in 2001 and 151 who were not. Although there are ways to account for the substantial attrition biases over time, the small numbers by 2012 will make it difficult to assess interactions and carry out complex multivariable models. On the other hand, if most of the attrition of women who reported spousal migration at baseline is due to mortality, I could carry out survival analysis, testing spousal migration to the U.S. as a predictor of mortality.

The second opportunity for future work on the question of spousal migration to the U.S. and the later-life health of older Mexican women involves an analysis of two “cohorts” of MHAS respondents. The 2012 MHAS survey involved not only a follow-up interview with the original respondents, but a “refreshed” sample of new study participants who were 50 years and older at the time of the new survey (i.e. born before 1962; those in the original survey were born before 1951). I would be able to compare the effects of spousal migration to the US on the health outcomes of women from these two different samples to see if there are distinct effects, given the potential for shifts in women’s participation in U.S. migration, internal migration in Mexico, and labor outside the home in Mexico for these slightly different, although overlapping cohorts.

These longitudinal and repeated cross-sectional analyses could also be carried out just as easily for the analysis of U.S. migration experience and later-life health for older Mexican men, although my findings here suggest that the results might be less promising, at least in the case of depression, hypertension, and diabetes. Further inquiry into the effects of U.S. migration on physical functioning and disability trajectories might be of interest, given the kind of occupational exposures faced by labor migrants to the U.S. during the Bracero Era and beyond (de Oca et al., 2011). Although shifting to analyses of alternative outcomes for a longitudinal analysis might be more fruitful, there is also considerable concern with the attrition of the already small numbers of U.S. migrant men, particularly if I am interested in stratifying by characteristics of the migrant experience (e.g. time since return, cumulative time abroad, number of trips, and so on).

I could additionally follow-up with the analysis of U.S. return migration and later-life health for Mexican men in the new “cohort” that was added in 2012 to see if effects change across cohorts. For example, younger cohorts may include more men who migrated to the US without documents, which might contribute to more difficult crossings and greater stressors living in the U.S., which might in turn yield a stronger association with later-life health outcomes. A final line of research that might be of interest in the case of the male sample is the effect of other family migration. My very limited inquiry into the effects of U.S. migration of parents and/or siblings, and adult children, suggest that men might experience adverse health effects of being ‘left behind’, particularly by the former group. These analyses might be extended into a longitudinal framework, or in an a comparative analysis across ‘cohorts’

The substantial sample attrition from the baseline MHAS survey might also preclude an analysis of the moderating effects of personal and family U.S. migration the relationship between early life conditions and later-life health outcomes, as I explored in my third chapter. Nonetheless, there are other aspects of that chapter that I might explore with a longitudinal analyses or an analysis of two “cohorts” represented by the 2001 and 2012 MHAS samples. For one, there is a great deal of opportunity to study the influences of early-life socio-economic and health status on changes in later-life health outcomes over the 11-year study period. This work is already under way to some extent among early users of the longitudinal Mexican Health and Aging Study, and has the added benefit of testing for the ‘cumulative’ effects of early-life disadvantage, or how disadvantage may or may not lead to widening disparities in health outcomes over time (Torres et al., 2014). The question of whether U.S. migration, including the US migration of family members, is a mediator of these long-term effects of early-life conditions could still be explored in a longitudinal framework.

7.6 Summary

My dissertation research responds to the need to examine predictors of later-life health in Mexico within the context of rapid demographic and epidemiologic change. Within this context, there is an urgent need to understand how social determinants shape the health of the growing older adult population in Mexico, and my research has shed light on some of these social determinants at the intersection of U.S. migration, gender, and socio-economic status. This research supports policy efforts to provide economic safety nets and reduce inequality across the life-course. In the absence of such policy changes, early-life socio-economic disadvantage may translate into adverse later-life health effects with high costs for families with older adults. Of course, early life disadvantage in Mexico is a moving target given the rapidly changing epidemiological profile. Although malnutrition and poverty continue to be a concern in many areas of Mexico, rates of childhood obesity are rising. Research on life-course determinants of health might turn its efforts in younger birth cohorts to examine how a mix of socio-economic disadvantage and over-nutrition impact later-life health.

In the absence of economic supports across the life-course, U.S. migration continues to be the only option for many Mexican families. Undocumented U.S. migrants in particular are subject to increasing structural vulnerability, including greater risks at the border, that may both limit their ability to return and may lead to more adverse health outcomes than observed for this sample of older Mexican adults whose U.S. migration was mostly concentrated around the Bracero Era and the decade following the end of the Bracero program. Further research on the long-term health of return U.S. migrants, including in-depth qualitative work with older men and women from cohorts represented by the MHAS and younger cohorts would shed more light on unmet needs for economic support and healthcare for these groups.

Family members who stay in Mexico are caught between the shifting epidemiological and demographic landscape, and the rise of migration to the U.S. over the course of the 20th and early 21st centuries. I have uncovered a particularly vulnerable group: older women whose spouses migrated to the U.S. but are no longer in a union, who often carried the double burden of raising children alone and working outside the home. More mixed methods and longitudinal research might disentangle the relationship between spousal migration to the U.S., marital dissolution, labor, and later-life health. This research might inform policy efforts and health interventions to support women who are disadvantaged across these multiple axes of power and privilege, and face a greater burden of costly chronic disease later in life.

Appendix A: Sensitivity Analysis for Doctor-Diagnosed Conditions

A. 1. U.S. migration and the health of older Mexican men

Although there are few significant associations between U.S. migration experience and later-life hypertension or diabetes for older men in Mexico, I re-ran simple analyses and interaction models limited only to respondents with recent tests of hypertension or diabetes, respectively. While many who report diagnosis of either chronic disease may have been tested well before two years ago, this sensitivity test restricts the analysis to those who are most likely to have accurate information about their chronic disease status (e.g. not reporting that they have never been diagnosed with diabetes or hypertension simply because they have never undergone a test for either one).

In Table A.1 I show that there continue to be no significant associations between U.S. migration experience and later-life hypertension or diabetes when restricting the sample to those who have had recent tests for these respective conditions. This was largely unchanged from the unrestricted simple models, except that there was no longer a significant association in the restricted models between being a non-migrant and having a parent or sibling who has gone to the U.S. to live or work and later-life hypertension. However, there does appear to be a significant association between this indicator of respondent's being left behind by U.S. migrant family members and later-life hypertension in a multivariable model restricted to those who have had a test for hypertension, which I show in Table A.2.

I additionally replicated the analyses of interactions between U.S. migration and current socio-economic status, and U.S. migration and residence characteristics, in the effect on later-life hypertension and diabetes. As with the unrestricted analyses, I found no evidence of significant interactions between U.S. migration and SES or residence characteristics for either health outcome using a multiplicative interaction methodology (not shown). I show the results of the additive interaction effects that I found to be significant in Chapter Five and then restricted to respondents with recent diabetes or hypertension tests in Tables A.3 and A.4. There were slight differences when using the restricted models. There was a significant additive interaction between U.S. migration experience and living in a high U.S. out-migration state in Mexico on the effect of diabetes for the full sample of male respondents. While the coefficients were largely unchanged for the restricted model, the additive interaction term was no longer significant when restricting to only those who had taken a diabetes test in the past two years. The significant additive interaction term between U.S. migration and self-rated financial circumstances on the effect of hypertension remained similar for the model that restricted the sample to those who had recent tests for hypertension as compared to the unrestricted analysis.

I repeated the above analyses and tests of interaction effects restricting to men who had some form of health insurance coverage in 2001 and to men who have some usual source of medical care, respectively. It is possible that those respondents with better access to care are less likely to have undiagnosed conditions that could skew the results for 'doctor-diagnosed' health outcomes. For the most part, I find no significant associations between U.S. migration experience and later-life hypertension and diabetes for these restricted samples, including for different categorizations of U.S. migration experience by number of trips, cumulative time abroad, or time since most recent return to Mexico. Among these different tests, there is one exception – being return U.S. migrants who report returning 29 years or more before the time of the survey have significantly greater odds of later-life hypertension compared to those with no

U.S. migration experience when restricting the sample to the 3571 men who report having a usual source of medical care (OR: 1.32, $p<0.05$, 95% CI: 1.06, 1.67; not shown).[56]

In contrast to the interaction models for the unrestricted sample, and in some cases for the samples restricted to those who had recent tests for diabetes or hypertension, I find no significant interaction effects between U.S. migration experience and current socio-economic status or residence characteristics when estimating later-life hypertension and diabetes (not shown). These null findings hold for interaction effects tested in both multiplicative and additive methods. This might be because when I exclude those with no usual source of medical care or no health insurance coverage, I remove a great deal of the variance in the socio-economic status of the sample. I would be less likely to see *differences* in the effect of U.S. migration by socio-economic status if I eliminate the variability in socio-economic status. Similarly, I am likely reducing some of the variability in the effects of residence characteristics, since those who live in rural areas or in high out-migration status and have health insurance coverage in Mexico are likely to be of higher socio-economic standing – either with occupational histories in government or other formal sectors that provided them with health insurance, or with other sources of income and assets that enable access to health care.

Finally, the composite indicator of both respondent and family migration experience shows no significant association with later-life health when I restrict the sample to respondents with a usual source of care. When I restrict to men who had some health insurance coverage in

[56] There is clear potential for this finding to be entirely confounded by age. That is, those return migrants who reported returning to Mexico 29 years or more before the survey are older on average than those who returned less than 29 years ago. Indeed, the significant simple association goes away when I control for baseline age.

2001, the pattern is somewhat similar to the simple analyses for the full sample – those respondents with no U.S. migration experience but who report that their parents and/or siblings moved to the U.S. to live or work have significantly greater odds of later-life hypertension compared to those with no personal or family U.S. migration experience (OR: 1.21, $p<0.05$, 95% CI: 1.01, 1.44). This indicator of no respondent U.S. migration but family U.S. migration remains a significant predictor of later-life hypertension in the full multivariable model restricted to those with some health insurance coverage (OR: 1.24, $p<0.05$, 95% CI: 1.04, 1.49).

Table A.1. Simple logistic regression models of hypertension and diabetes for older Mexican men with recent tests for hypertension or diabetes, by US migration history.

	Doctor-diagnosed hypertension (n=3230)			Doctor Diagnosed Diabetes (n=3227)		
Binary[a]	OR		95% CI	OR		95% CI
US return migrant	1.09		(0.91, 1.30)	0.90		(0.71, 1.12)
Respondent and family migration experience[b]						
R did not migrate, family did	1.12		(0.95, 1.32)	1.03		(0.84, 1.26)
R migrated, family did not	1.27		(0.98, 1.64)	0.87		(0.62, 1.22)
Both R and family migrated	1.01		(0.80, 1.28)	0.92		(0.69, 1.24)
Three-category models[c]						
≤ 29 years since migration (more recent migration)	0.99		(0.76, 1.30)	0.89		(0.62, 1.29)
> 29 years since migration (more distant migration)	1.18		(0.94, 1.47)	0.91		(0.69, 1.21)
One trip abroad only	1.11		(0.88, 1.40)	0.97		(0.73, 1.29)
More than one trip abroad	1.08		(0.83, 1.40)	0.82		(0.57, 1.18)
≤ 5 years abroad	1.19		(0.97, 1.46)	0.95		(0.73, 1.23)
> 5 years abroad	0.86		(0.62, 1.17)	0.78		(0.51, 1.17)

Source: Mexican Health and Aging Study, 2001, *$p<0.05$, **$p<0.01$, ***$p<0.001$. Note: A. Ref= No U.S. Migration. B. Ref=Neither R nor family migrated, C. Ref = No Migration Experience

Table A.2. Multivariable model of doctor-diagnosed hypertension for older Mexican men with a recent test for hypertension by personal migration history and time since last migration to the US

	Diabetes (n=3196)			Hypertension (n=3696)		
	OR		95% CI	OR		95% CI
Respondent and family migration experience						
R did not migrate, family did	1.05		(0.85, 1.30)	1.19	*	(1.01, 1.41)
R migrated, family did not	0.89		(0.63, 1.25)	1.21		(0.93, 1.58)
Both R and family migrated	0.95		(0.70, 1.29)	1.01		(0.82, 1.25)
LR Chi-squared	95.6	***		49.2	***	

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.001. Note: Ref=Neither R nor family migrated

Table A.3. Relative risk ratios for logistic regression model of hypertension for older Mexican men with a recent test for hypertension by US migration history with interaction, (n=3686)[a]

	RR		95% CI
US migrant	1.02		(0.68, 1.53)
Poor self-rated economic situation	1.27	*	(1.05, 1.52)
US migrant and poor self-rated economic situation	1.31	*	(1.02, 1.68)
US migrant	1.19		(0.99, 1.41)
US migrant family member	1.23		(0.93, 1.63)
US migrant and US migrant family member	0.99		(0.77, 1.26)

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status and childhood and adult SES characteristics

Table A.4. Relative risk ratios for logistic regression model of diabetes for older Mexican men who report a recent diabetes test by US migration history and residence characteristics (n=3187)[a]

	RR		95% CI
US migrant	0.61	*	(0.39, 0.96)
Lives in urban area	1.00		(0.80, 1.26)
US migrant and lives in urban area	1.05		(0.76, 1.45)
US migrant	1.02		(0.76, 1.36)
Lives in high out-migration state	0.99		(0.80, 1.23)
US migrant and high out-migration state	0.71		(0.50, 1.03)

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status and childhood and adult SES characteristics

A.2 Spousal migration to the U.S. and the health of older Mexican women

I re-tested all results for the multivariable models regressing diabetes and hypertension, respectively, on spousal migration history, and the full set of demographic and socio-economic controls to those respondents that report having received a test for diabetes or hypertension in the last two years. This analysis appears to be particularly important given that those who report spousal migration to the U.S. also report higher frequencies of recent tests for hypertension and diabetes, respectively.

As shown in Table A.5, there is no difference in the significance of the associations between the measure of spousal migration and current marital status and each of the health outcomes when comparing the results using the full sample to the results restricted to those who have had recent tests for these conditions. The only difference is that the size of the effect of reporting spousal migration and not currently in a union on doctor-diagnosed diabetes (relative to those with no spousal migration and currently married) is slightly larger. The odds of doctor-diagnosed diabetes are 45% higher for those with spousal migration and no current union compared to their counterparts with no spousal migration and currently in a union in the model restricted to those who have had a recent test for diabetes ($p<0.01$) compared with the model not limited to 36% greater odds in the model with no restriction based on recent testing for diabetes.

There are some changes when I restrict the model to those currently not in a union, using a binary measure of spousal migration as my key independent variable (Table A.6). Here, the effect size and significance level for the model predicting diabetes-diagnosis increases considerably compared to the model that is not limited by whether or not respondents had a recent test for diabetes. Specifically, the odds of diabetes for those with spousal migration who are not currently in a union are 61% ($p<0.01$) greater than those with no spousal migration history to the U.S. in the unrestricted model, while in model restricted by recent diabetes tests the odds of diabetes are 79% greater for those with spousal migration history compared to those without ($p<0.001$). There is almost no difference in the effect size and significance level when comparing models predicting hypertension diagnosis that are restricted and unrestricted by whether or not respondents report recent tests for hypertension.

I additionally attempt sensitivity tests that restrict analyses to whether or not respondents report having a usual source of medical care and whether or not they report some form of health insurance coverage in 2001, respectively Tables A.7 and A.8). There continue to be no real changes in the effect size for the indicator of spousal migration history across models predicting hypertension across unrestricted and all versions of the restricted models, for those analyses limited to those not currently married or in a union. Across all iterations, those with spousal migration history are predicted to have 41 or 42% greater odds of reporting doctor-diagnosed hypertension compared to their counterparts who report no spousal migration to the U.S., all else equal ($p<0.05$ across models).

However, there continues to be some fluctuation across models predicting diabetes with different specifications of access to care, which may underscore the importance of access to health care and the quality of that care (e.g. that includes tests for diabetes) in shaping respondents knowledge of their diabetic status. Above, I described significant changes in effect size and significance level for the measure of spousal migration to the U.S. in models of diabetes when restricted or unrestricted by whether or not respondents report a recent test for diabetes. When I restrict the model to those with a usual source of care, the effect size and significance of the indicator of spousal migration to the U.S. are both smaller compared to the original unrestricted model (OR: 1.51, $p<0.05$ compared to OR: 1.61 and $p<0.01$ for the unrestricted model). On the other hand, when I limit the model to those with some form of health insurance coverage in 2001, the effect size and significance level of the indicator of spousal migration increases (OR: 1.84, $p<0.001$).

The ability to compare directly across these models is somewhat limited by the widely fluctuating sample sizes based on what kind of restriction I impose. If I relax the concern with comparability, the results across the sensitivity analyses suggest that the adverse effect of spousal migration on later-life diabetes, at least for those not currently in a union, is somewhat obscured by the relative advantage that those with some spousal migration history have in terms of access to health insurance coverage and testing for diabetes (see Table A.2); the effect of spousal migration history on later-life diabetes increases when I account for these differences by restricting my analysis to those who report better access to care, and who are more likely to have an accurate sense of whether or not they have diabetes. It appears that access to care is less important in terms of respondents' accurate reporting of their hypertension status, given little fluctuation in the effect of spousal migration across models restricted by testing history and access to care. This may be due to the fact that access to blood pressure readings is likely much more widespread that blood tests necessary for diabetes diagnoses, as community health workers or nurses may carry blood pressure cuffs or community clinics carry them, even if they do not have access to laboratories needed for diabetes tests.[57]

Table A.5. Multivariable model of past-week depression, hypertension and diabetes for older Mexican women by spousal migration history, limiting analysis to respondents who had tests for either hypertension or diabetes.

	Hypertension (n=4749)			Diabetes (n=4278)		
	OR		95% CI	OR		95% CI
Spousal Migration History						
No spousal migration, not currently in union	0.92		(0.79, 1.09)	0.83		(0.68, 1.02)
Spousal migration, currently in union	1.00		(0.82, 1.23)	1.06		(0.83, 1.36)
Spousal migration, not currently in union	1.25		(0.94, 1.66)	1.45	*	(1.05, 2.00)
LR Chi-squared	**75.5**	***		**108.4**	***	

Source: Mexican Health and Aging Study, 2001 and 2003, *p<0.05, **p<0.01, ***p<0.001. Notes: Controlling for age, residence characteristics, personal migration history, family demographics (marital status, total number of years married, number of live births, whether or not raised children alone), and childhood and adult SES characteristics.

[57] Diagnosis of hypertension requires a protocol that generally involves multiple blood pressure readings at different time points. Of course, the degree to which this is understood by respondents or practiced by those who diagnose them is impossible to tell from this data.

Table A.6. Multivariable model of hypertension and diabetes for older Mexican women by spousal migration history, for women not currently in a union, and who have had a recent test for hypertension or diabetes, respectively.

	Hypertension			Diabetes		
	(n=1810)			**(n=1618)**		
	OR		95% CI	OR		95% CI
Spouse Migration to the US	1.41	*	(1.07, 1.86)	1.79	***	(1.31, 2.45)
LR Chi-squared	**33.8**	**		**36.1**	**	

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.001. Notes: Controlling for age, residence characteristics, personal migration history, family demographics (marital status, total number of years married, number of live births, whether or not raised children alone), and childhood and adult SES characteristics.

Table A.7. Multivariable model of hypertension and diabetes for older Mexican women by spousal migration history, for women not currently in a union, and who have a usual source of medical care for minor health concerns (n=1554).

	Hypertension			Diabetes		
	OR		95% CI	OR		95% CI
Spouse Migration to the US	1.42	*	(1.05, 1.91)	1.51	*	(1.07, 2.11)
LR Chi-squared	**28.4**	*		**25.6**	*	

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.001. Notes: Controlling for age, residence characteristics, personal migration history, family demographics (marital status, total number of years married, number of live births, whether or not raised children alone), and childhood and adult SES characteristics.

Table A.8. Multivariable model of hypertension and diabetes for older Mexican women by spousal migration history, for women not currently in a union, and who have health insurance coverage in 2001 (n=773).

	Hypertension			Diabetes		
	OR		95% CI	OR		95% CI
Spouse Migration to the US	1.42	*	(1.04, 1.93)	1.84	***	(1.31, 2.59)
LR Chi-squared	**40.6**	***		**37.0**	***	

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.001. Notes: Controlling for age, residence characteristics, personal migration history, family demographics (marital status, total number of years married, number of live births, whether or not raised children alone), and childhood and adult SES characteristics.

A.3 U.S. migration as mediator or moderator of the relationship between early-life and later-life health

I re-ran analyses of the relationship between early life socio-economic and health conditions and later-life hypertension and diabetes, restricting to samples who reported recent test for hypertension and diabetes. For women, there were actually more significant relationships using the samples restricted to those with recent tests (Table A.9). For example, lacking household sanitation facilities as a child is associated with 16% greater odds of doctor-diagnosed hypertension ($p<0.01$) among all female respondents, but with 24% greater odds of doctor-diagnosed hypertension among women who report having a test for hypertension in the past two years ($p<0.001$). For almost all of the other remaining indicators of childhood socio-economic status and health, the significance level and effect size increases for the analyses with restricted samples. This means that the effect of early life conditions on later-life chronic disease seems to be even more pronounced among the sample of women who are more likely to have had recent tests – that is, women who have health insurance coverage, who have better current socio-economic conditions, and consequently better access to healthcare.[58]

The effect was the opposite for men (Table A.10), whereby the simple associations between early life SES and health conditions and later-life chronic disease were weakened when restricting the sample to men who had recent tests for hypertension and diabetes. For example,

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[58] In an ancillary analysis, I ran a multivariable logistic regression predicting recent tests for diabetes and hypertension, respectively, among women; controls included demographic and residence characteristics, personal and spousal migration history, and current socio-economic indicators. Having health insurance coverage at the time of the survey was the strongest predictor of having a test for hypertension (OR: 2.29, $p<0.001$) or diabetes (OR: 2.61, $p<0.001$). Reporting below the median monthly household income was associated with lower odds of a recent test for hypertension but not diabetes. Each additional household item (e.g. refrigerator, telephone) was associated with 13% greater odds of a recent test for hypertension ($p<0.001$) and 11% greater odds of a diabetes test in the past two years ($p<0.001$), all else equal.

lacking household sanitation facilities as a child was significantly associated with greater odds of later-life hypertension for the full sample of male respondents, but not when restricted to men who had a test for hypertension in the past two years. Reporting a serious childhood illness is no longer significantly associated with later-life diabetes, and neither is respondent education. This suggests that part of the effect of early life socio-economic and health status on later-life health outcomes is through the effect of these early-life conditions on access to healthcare that might facilitate better diagnoses of later-life chronic disease. Once the variance in recent testing – a potential proxy for access to health care – is eliminated, some of the effects of early life conditions diminish.[59]

I move on to tests of the possibility that U.S. migration experience mediates the relationship between early-life conditions and later-life health. For the sake of efficiency, I resort directly to KHB decomposition models testing whether or not there is a significant difference in models of the association between childhood socio-economic and health status and later-life hypertension and diabetes with and without indicators of U.S. migration experience, restricted only to respondents with recent tests of the respective disease modeled. As with analyses using the full samples, I find no evidence that U.S. migration experience – either personal in the case of men or spousal in the case of women – mediates the life-course relationships between early

[59] Multivariable logistic regression analyses predicting recent tests for hypertension and diabetes, respectively, for the male sample reveal some distinct results from the analyses for women. Older men and men living in more urban environments have significantly greater odds of reporting recent tests for hypertension or diabetes. Reporting lifetime occupation in the agricultural sector is associated with significantly reduced odds of a recent test of either kind, as is reporting no formal education, even when controlling for other socio-economic indicators. As with the female sample, however, lacking health insurance coverage remains the strongest predictor of recent tests for diabetes or hypertension, respectively.

life conditions and later-life chronic disease (not shown). Nevertheless, I report the results of multivariable models of hypertension and diabetes that include early-life indicators of SES and health alongside US migration indicators in Tables A.11 and A.12. I re-run these mediation tests restricting to respondents who report having a usual source of health care, and to respondents with health insurance coverage in Mexico, respectively, and continue to find no evidence of mediation effects.

I move on to tests of interactions between early-life SES indicators and US migration experience on the association with later-life hypertension and diabetes. In the case of men, I find similar results for tests of interaction effects using the samples restricted to those who had recent tests for hypertension and diabetes as to those analyses using the unrestricted sample. Specifically, I find no significant additive interaction effects between any of the early-life indicators and U.S. migration experience for either of the two health outcomes with and without restriction to male respondents who report recent tests for hypertension or diabetes. Using a multiplicative approach, I continue to find a significant interaction effect between respondent education and US migration experience on later-life diabetes, and with the same qualitative implications (Table A.13). That is, the results continue to suggest that men with lower levels of education who went to the US have significantly greater odds of later-life diabetes than their counterparts with lower levels of education but who remained in Mexico. The latter group appears to exhibit an inverse SES diabetes gradient, whereas I estimate that those with some US migration experience appear to have a positive SES-diabetes gradient.

Finally, there are major divergences for women between models that do and do not restrict for recent tests of hypertension or diabetes, to respondents who reported a usual source of health care, and to respondents who report health insurance coverage, respectively. When restricting to female respondents who report having been tested for hypertension in the past two years, I estimate a significant interaction between the indicators of serious childhood illness and spousal migration to the U.S. Using the multivariable interaction method, it appears that the adverse effects of spousal migration to the US exacerbate the already adverse effects of serious childhood illness on later-life hypertension ($p<0.05$), limited to women who reported a usual source of medical care (Table A.14). There is a similar pattern for the interaction between serious childhood illness and spousal migration. However, these significant interaction effect are the result of about 20 multiplicative interaction models between models that use either binary and four-category measures of spousal migration to the US and outcomes of diabetes and hypertension. There are only two significant outcomes for all tests of interactions between early-life conditions and spousal migration to the US using the additive interaction method across all sensitivity analyses restricting the sample of female respondents based on recent tests for hypertension or diabetes, usual source of medical care, and reporting health insurance coverage at the time of the survey. As with the multiplicative results, spousal migration to the US appears to exacerbate the effect of serious illness on the risk of later-life hypertension and diabetes (see Table A.15 for the model of diabetes).

Table A.9. Simple logistic regression models of hypertension and diabetes for older Mexican women by indicators of childhood health and socio-economic status for respondents who report having taken a test for hypertension or diabetes in the past two years.						
	Doctor-diagnosed hypertension (n=5278)			**Doctor Diagnosed Diabetes (n=4738)**		
2001 Characteristics	OR		95% CI	OR		95% CI
No sanitation facilities before age 10	1.24	***	(1.11, 1.39)	1.17	*	(1.02, 1.35)
Serious illness before age 10	1.19	*	(1.00, 1.41)	1.40	**	(1.15, 1.71)
R has no education	1.18	**	(1.04, 1.34)	1.38	***	(1.19, 1.61)
Mother has no education	1.20	**	(1.08, 1.35)	1.34	***	(1.16, 1.55)
Don't know mother's education	1.40	**	(1.15, 1.71)	1.23		(0.97, 1.57)
2003 Characteristics	**(n=4640)**			**(n=4213)**		
Father's occupation (Ref=Agriculture)						
Construction	0.89		(0.74, 1.06)	1.19		(0.97, 1.46)
Garden	0.76	*	(0.62, 0.94)	0.88		(0.68, 1.13)
Restaurant	0.81		(0.66, 1.01)	0.84		(0.64, 1.11)
Office or other	0.80	*	(0.64, 0.99)	0.72	*	(0.55, 0.96)
No parent/don't know	0.89		(0.69, 1.14)	0.96		(0.71, 1.31)
Frequently went to bed hungry before age 10	1.21	**	(1.07, 1.37)	1.34	***	(1.15, 1.56)
Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.001						

Table A.10. Simple logistic regression models of hypertension and diabetes for older Mexican men by indicators of childhood health and socio-economic status for respondents who report having taken a test for hypertension or diabetes in the past two years.						
	Doctor-diagnosed hypertension (n=3724)			**Doctor Diagnosed Diabetes (n=3220)**		
2001 Characteristics	OR		95% CI	OR		95% CI
No sanitation facilities before age 10	1.15		(0.99, 1.32)	1.12		(0.94, 1.34)
Serious illness before age 10	1.32	**	(1.08, 1.61)	1.20		(0.94, 1.53)
R has no education	0.99		(0.84, 1.18)	1.09		(0.88, 1.35)
Mother has no education	1.08		(0.94, 1.24)	1.25	*	(1.05, 1.49)
Don't know mother's education	1.05		(0.82, 1.33)	1.35	*	(1.00, 1.82)
2003 Characteristics	**(n=3216)**			**(n=2857)**		
Father's occupation (Ref = Agriculture)						
Construction	0.99		(0.80, 1.23)	1.31	*	(1.02, 1.69)
Garden	1.03		(0.80, 1.32)	1.14		(0.85, 1.54)

Restaurant	1.17		(0.88, 1.55)	1.35		(0.97, 1.89)
Office or other	1.08		(0.83, 1.41)	1.18		(0.86, 1.61)
No parent/don't know	0.84		(0.58, 1.19)	1.05		(0.69, 1.60)
Frequently went to bed hungry before age 10	1.10		(0.95, 1.28)	0.87		(0.72, 1.06)

Source: Mexican Health and Aging Study, 2001 and 2003, *p<0.05, **p<0.01, ***p<0.001

Table A. 11. Multivariable logistic regression models of hypertension and diabetes for older Mexican men by indicators of childhood health and socio-economic status for respondents who report having taken a test for hypertension or diabetes in the past two years.

	Hypertension (n=3686)			Diabetes (n=3220)		
2001 Childhood characteristics	OR		95% CI	OR		95% CI
No sanitation facilities before age 10	1.10		(0.94, 1.29)	1.19		(0.99, 1.43)
Serious illness before age 10	1.30	*	(1.05, 1.59)	1.28	*	(1.02, 1.61)
R has no education	0.87		(0.71, 1.05)	0.95		(0.77, 1.19)
Mother has no education	1.04		(0.89, 1.21)	1.18		(0.99, 1.41)
Don't know mother's education	0.96		(0.75, 1.23)	1.17		(0.88, 1.56)
Demographics						
Age, years	1.02	***	(1.01, 1.03)	1.01	**	(1.00, 1.02)
Urban residence	1.00		(0.85, 1.19)	1.18		(0.97, 1.43)
High out-migration state	0.97		(0.83, 1.13)	1.18		(0.97, 1.43)
Return US migrant	1.03		(0.86, 1.25)	0.92		(0.74, 1.14)

Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.001. Notes: Controlling for lifetime occupational status (agricultural/domestic versus other), number of items in R's household, ranging from 0-6 items, and poor self-rated economic status, BMI

Table A.12. Multivariable logistic regression models of hypertension and diabetes for older Mexican women by indicators of childhood health and socio-economic status for respondents who report having taken a test for hypertension or diabetes in the past two years.

	Hypertension (n=4726)			Diabetes (n=4255)		
2001 Childhood characteristics	OR		95% CI	OR		95% CI
No sanitation facilities before age 10	1.08		(0.94, 1.23)	0.97		(0.82, 1.15)
Serious illness before age 10	1.19		(0.99, 1.43)	1.37	**	(1.10, 1.69)
R has no education	0.99		(0.85, 1.16)	1.18		(0.99, 1.42)
Mother has no education	1.09		(0.95, 1.25)	1.11		(0.94, 1.32)
Don't know mother's education	1.31		(1.05, 1.64)	0.99		(0.77, 1.31)
Demographics						
Age, years	1.02	***	(1.01, 1.03)	1.01		(0.99, 1.02)
Urban residence	0.96		(0.83, 1.11)	1.22	*	(1.02, 1.46)
High out-migration state	0.98		(0.86, 1.12)	0.66	***	(0.56, 0.79)
R migrated (mostly internal)	1.02		(0.90, 1.15)	0.83	*	(0.71, 0.97)
Four-category spousal migration (Married, no US spouse)						
Not married, no US spouse	0.92		(0.78, 1.08)	0.82		(0.67, 1.01)
Married, US spouse	0.98		(0.80, 1.21)	1.07		(0.83, 1.37)
Not married, no US spouse	1.23		(0.93, 1.65)	1.49	*	(1.08, 2.06)

Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.001 Notes: a. Controlling for number of live births, total time married, whether R ever raised children alone, occupational history, self-rated economic status, number of household items, and BMI.

Table A.13. Logistic regression model of diabetes for older Mexican men, with interactions between respondent's education and US migration history for those with recent diabetes tests, (n=3205)[a]

	OR		95% CI
R has no formal education	0.87		(0.67, 1.13)
Return US migrant	0.77		(0.59, 1.01)
No formal education*return US migrant	1.81	*	(1.06, 3.09)

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status, and other childhood characteristics.

Table A.14. Logistic regression model of hypertension for older Mexican women, with interactions between childhood illness and spousal migration to the US, restricted to women who report a usual source of medical care (n=4073)[a]

	OR		95% CI
Serious illness before age 10	1.32	*	(1.06, 1.64)
Spouse migrated to US	1.15		(0.95, 1.39)
Serious illness+ spouse migrated to US	1.77	*	(1.09, 2.86)

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status, and other childhood characteristics.

Table A.15. Logistic regression model of diabetes for older Mexican women, with interactions between childhood illness and spousal migration to the US, restricted to women who report a usual source of medical care (n=4079)[a]

	OR		95% CI
Serious illness before age 10	1.34	*	(1.03, 1.72)
Spouse migrated to US	1.14		(0.90, 1.44)
Serious illness+ spouse migrated to US	1.85	*	(1.10, 3.09)

Source: Mexican Health and Aging Study, 2001 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status, and other childhood characteristics.

Appendix B: Reliability Analysis

The objective of this analysis is to inquire into the reliability of measures of early childhood socio-economic and health conditions, given that they are retrospective reports supplied, in some cases, up to 80 years or more after the reference period for some of the oldest participants in the Mexican Health and Aging Study (MHAS). There have been two previous attempts to analyze the reliability of retrospective measures of early childhood health conditions for US-based studies (Haas, 2007), but no attempts have been made to undertake similar analyses with the MHAS data.

My basic methodology follows Haas' analysis of the reliability of retrospective childhood health reports using the Health and Retirement Study (HRS) and PSID data, by taking advantage of the fact that the same or similar questions about early childhood conditions were asked of MHAS participants both at baseline and two-year follow-up (Haas, 2007). These measures are not self-reported childhood health measures, as were available in the data studied by Haas, but pertain more to respondents' socio-economic and material conditions during childhood. One repeated question refers to whether or not respondents had household sanitation facilities in their household before age 10, a proxy for sanitation and health-related conditions, but also for childhood socio-economic status. The second repeated question refers to reports of mothers' educational attainment, a proxy for childhood socio-economic status.

By comparing responses at baseline and at two-year follow-up, I am able to define a group of study participants that gave discordant responses – that is, answered differently in 2001 compared to 2003 about conditions that necessarily could not have changed in between. In Table

B.1 I show the numbers of discordant cases on the measures of childhood sanitation and mother's education, as well as some descriptive characteristics of both concordant and discordant groups.

For the measure of childhood sanitation facilities, I note that just over one thousand respondents, or about 10% of the total sample completing both 2001 and 2003 waves, have discordant cases that are implausible. Because there were slight differences in the way the question was asked, with the 2001 survey referring to sanitation facilities in the household and the 2003 version asking about sanitation facilities *inside* the household. It is possible that some respondents correctly stated that they had household sanitation facilities in 2001, but in 2003 clarified that that had no such facilities inside their household, as would be the case with an outhouse. These cases are discordant technically, but plausible. The cases that are more concerning in terms of reliability are those that said that they did not have sanitation facilities in their household at all in 2001, but did have them inside their household in 2003. Again, I have labeled these over one thousand cases as both discordant and implausible, although I assess differences in descriptive characteristics by these specific categories of discordant responses (plausible/implausible) in Table B.1.

The numbers in Table B.1 suggest a number of puzzles related to who provides discordant and concordant responses. For one, those with concordant responses tend to skew slightly older compared to those with any kind of discordant response: 22% of those who had consistent reports of having household sanitation facilities as a child or not were 70 years or older at baseline, compared to 16% of the discordant/plausible group, and 19% in the discordant/implausible group. Those with concordant responses were also less likely to have any education compared to their counterparts with wavering accounts of their childhood circumstances; 28% of those with concordant responses reported no educational attainment compared with 13% of those with discordant/plausible responses and 16% of those with discordant/implausible responses. These findings run counter to the findings and logic of Haas' reports on the characteristics of discordant reporters of childhood self-rated health among older US study participants: those who are older and have less education are expected to have more limited cognitive functioning compared to their younger, less educated respondents, and are therefore more likely to have differing responses from one study wave to the next. These results suggest the opposite, at least at the descriptive level.

The descriptive findings for response types by health characteristics are mixed, and continue to be puzzling. Those with concordant responses appear to be more likely to report depression in both 2001 and 2003 compared with their discordant counterparts with both plausible and implausible responses. Those with discordant but plausible responses were the most likely of all groups to report both diabetes and hypertension. Finally, for a more direct measure of subjective health changes between the study waves, to assess whether or not responses about the past are "anchored" to some degree by current health experiences, I examine responses by whether respondents suggest their health improved, worsened, or stayed the same between the two-year study period. Those with concordant responses – as in those with the least evidence of responses that shift according to current circumstances – were the most likely to report worse health in 2003 compared with 2001. Those with discordant/implausible responses were the most likely to report better health in 2003 compared with two years earlier; this is potentially evidence of respondents' reporting better childhood circumstances (that they did have sanitation facilities inside their household) in the same year that their health had improved. This provides some evidence of anchoring discordant responses of childhood circumstances based on current health context, whereby improved health now contributes to rosier retrospective reports of material conditions in childhood.

Next I turn to descriptive findings for concordant and discordant responses to a question about mother's level of education asked in both 2001 and 2003 (Table B.1). This measure is a bit more straightforward, given that the question was asked in exactly the same way at both waves; the answers are either the same or not. There appear to be some demographic differences in the composition of concordant and discordant respondents. Those with discordant responses tend to have a slightly higher proportion of males (46% compared to 43% of concordant respondents, $p<0.05$), and tend to skew older than their counterparts with concordant responses (23% were 70 years or older at baseline compared to 20% of those with concordant responses, $p<0.001$). This finding for those in older age groups being less likely to report reliable (or at least consistent) responses to retrospective questions about childhood is more in line with previous research by Haas.

However, I find again that those with discordant responses were more likely to have some educational attainment compared to their counterparts. This again is a confusing result given Haas' finding from U.S. data that those who have less education are more likely to report discordant responses about childhood health from one study wave to the next. Despite these mixed demographic results, the remaining descriptive findings suggest that there are no significant differences in the health composition of those with concordant versus discordant responses.

From the descriptive results, I move on to simple and multivariable analyses predicting whether or not respondents report discordant versus concordant respondents. For the measure of childhood sanitation, I report results based on a binary measure contrasting respondents with discordant and implausible reports to those with either concordant or discordant/plausible reports. I alternatively run multinomial logistic regressions looking at all three potential outcomes, and report on any relevant predictors of those with discordant/plausible retrospective responses.

For the simple regression results, I focus specifically on health measures as potential predictors of discordant responses. In Table B.2, I show that three health-related measures are significantly associated with the odds of discordant/implausible responses, keeping in mind that this group of respondents generally reported better childhood circumstances in 2003 compared to their responses in 2001. As suggested by the descriptive results, being more depressed in 2003, reporting an increase in number of depressive symptoms from 2001 to 2003, and reporting worse relative health in 2003 are each associated with lower odds of reporting discordant, implausible responses. Again, this suggests that those who were worse off in 2003 in terms of depression and overall self-rated health were less likely to change to a better retrospective account of childhood conditions from the first to the second waves. However, in Table B.3, I show no associations between health conditions and discordant responses on mother's education between 2001 and 2003, as suggested by the demographic results.

Finally, I run multivariable models predicting discordant answers on the question of childhood sanitation (Table B.4) and mother's education (Table B.5). In Table B.4, I show three models predicting discordant answers on childhood sanitation; all control for demographic characteristics, but add each of the health measures that had significant simple associations (see Table B.2) in turn. The results suggest that once I control for demographic characteristics, including gender, age, residence characteristics and respondents' educational attainment, that there is no significant association between changes in overall health from 2003 to 2001 and the odds of reporting discordant accounts of childhood access to sanitation facilities in the household across the same two years (Model 1). Models 2 and 3 show that, all else equal, being depressed in 2003 and a reporting an increase in depressive symptoms from 2001 to 2003 are each significantly associated with lower odds of reporting discordant accounts of childhood material conditions, all else equal ($p<0.05$). This continues to provide evidence of some anchoring of respondents' retrospective reports of childhood, at least with respect to current depressive symptoms.

Urban residence and residence in a high out-migration state are each significantly associated with greater odds of reporting discordant accounts of childhood sanitation facilities; those with no education are significantly associated with lower odds of reporting discordant accounts of childhood circumstances. These findings may reflect the fact that for those living in rural areas, and especially if they have never moved from that environment from childhood to now, there is little ambiguity as to what kind of childhood conditions they group up in: they were poor. Those in urban environments – during childhood and today – may have had access to more sanitation infrastructure during childhood that might make parsing out memories of whether sanitation facilities existed and where (*inside* the household, *in* the household), more difficult. Similarly, those who grew up with the lowest levels of socio-economic attainment (i.e. no education) may also be less likely to report any ambiguity around their childhood material circumstances; again, they were likely characterized by very poor material conditions, with little access to sanitation facilities (A. Palloni, 1981; Wong & Palloni, 2009) .

However, in Table B.5, analogous multivariable models for the measure of discordant answers on mother's educational attainment show no specific association between any of the health measures tested and the odds of discordant responses. This suggests that reports of mother's education might be less susceptible to an anchoring effect, at least in terms of depression. The models in general suggest that those at older baseline ages were associated with greater odds of reporting discordant answers related to their mother's education from one study wave to the next. It may be that those at older ages have lower cognitive functioning, which makes such retrospective reports more difficult, but it also may be that those at older ages have less recent memories of their mother's own educational histories, given that their mothers are much more likely to be deceased, and to have been deceased for longer periods of time. The findings for educational attainment are parallel to those for the models of discordant responses on indicators of childhood sanitation facilities. Those who report no educational attainment have lower odds of reporting discordant reports of their mother's education from one wave to the next. Again, it may be that those who had no education themselves were quite confident from one study wave to the next that their mothers also had no education.

Overall, these findings suggest that retrospective conditions of childhood socio-economic status and material conditions are quite reliable, with the majority of respondents reporting consistent answers at baseline and two year-follow up. Discrepancies appear to be more related to respondent's own socio-economic context – those with more education tended to also waver a bit more when reporting on indicators of childhood socio-economic conditions, whereas those in rural areas and with less education were more likely to be consistent about how advantaged or disadvantaged they were as children. There was some evidence of respondents anchoring retrospective reports to current health status, but only in the case of reporting household sanitation facilities during childhood, which appeared to be anchored somewhat depression and changes in depression. There are no significant associations between discordant responses on childhood circumstances and diabetes and hypertension. The finding that the measure of childhood sanitation facilities is somewhat anchored by current experiences with depression should be kept in mind particularly for results that link life-course socio-economic status to depression over time for this group of older respondents; mother's educational attainment may be an alternate or additional indicator of childhood circumstances that may waver less with current mental and emotional well-being.

Table B.1. Descriptive statistics for household sanitation facilities and parents' education at baseline and two-year follow-up for Mexican adults 50 and older in 2001 (n=10398)

	Consistent, No Household Sanitation	Consistent, Yes Household Sanitation	**Consistent, All**	**Discordant, Plausible**	**Discordant, Implausible**	**Concordant**	**Discordant**
Total	**5980**	**1764**	**7744 (100.0)**	**1600 (100.0)**	**1054 (100.0)**	7394	**2995**
Female (n=5795)	3231	1054	4285 (55.3)	925 (57.8)	585 (55.5)	4176 (56.5)	1615 (53.9)
Male (n=4603)	2749	710	3459 (44.7)	675 (42.2)	469 (44.5)	3218 (43.5)	1380 (46.1)
					χ^2 = 3.32, p=0.19		χ2 =5.64, p<0.05
Age at baseline							
50-54 (n=2202)	1028	521	1549 (20.0)	396 (24.8)	257 (24.4)	1632 (22.1)	566 (18.9)
55-59 (n=2792)	1486	527	2013 (26.0)	470 (29.4)	279 (26.5)	2004 (27.1)	761 (25.4)
60-70 (n=3262)	2001	469	2470 (31.9)	475 (29.7)	317 (30.1)	2274 (30.8)	985 (32.9)
70+ (n=2172)	1465	247	1712 (22.1)	259 (16.2)	201 (19.1)	1484 (20.1)	683 (22.8)
Respondent's Education					χ^2 = 52.3, p<0.001		χ2 =23.2, p<0.001
No education (n=2571)	2126	71	2197 (28.4)	210 (13.1)	164 (15.6)	1918 (25.9)	647 (21.6)
Any education (n=7827)	3854	1693	5547 (71.6)	1390 (86.9)	890 (84.4)	5476 (74.1)	2348 (78.4)
Health					χ^2 = 218.5, p<0.001		χ2 =21.6, p<0.001
Depressed, 2001 (n=3646)	2336	448	2784 (35.9)	521 (32.6)	341 (32.4)	2615 (35.4)	1026 (34.3)
Not depressed, 2001 (n=6752)	3644	1316	4960 (64.1)	1079 (67.4)	713 (67.7)	4779 (64.6)	2615 (35.4)
					χ^2 = 10.5, p<0.01		χ2 = 1.15, p=0.28
Depressed, 2003 (n=6593)	3503	1326	2915 (37.6)	557 (34.8)	333 (31.6)	2679 (36.2)	1126 (37.6)
Not depressed, 2003 (n=3805)	2477	438	4829 (62.4)	1043 (65.2)	721 (68.4)	4715 (63.8)	1869 (62.4)
					χ^2 = 17.2, p<0.001		χ2 = 1.71, p=0.19
Hypertension, 2001 (n=3912)[a]	2258	655	2913 (37.7)	619 (38.8)	380 (36.1)	2827 (38.3)	1082 (36.2)
No hypertension, 2001 (n=6210)	3521	1083	4604 (59.7)	955 (59.9)	651 (61.8)	4274 (59.3)	1831 (61.3)
					χ^2 = 11.8, p<0.05		χ2 = 4.07, p=0.13
Diabetes, 2001 (n=1604)	929	240	1169 (15.1)	284 (17.8)	151 (14.4)	1136 (15.4)	467 (15.6)
No diabetes, 2001 (n=8529)	4863	1497	6390 (82.3)	1292 (80.9)	877 (83.5)	6074 (82.3)	2448 (81.9)
					χ^2 = 17.3, p<0.01		χ2 = 0.27, p=0.87
Self-assessed health in 2003							
Better than 2001 (n=1132)	638	198	836 (10.8)	161 (10.1)	135 (12.8)	802 (10.9)	330 (11.0)
Same as 2001 (n=5420)	2828	1134	3962 (51.2)	881 (55.1)	577 (54.7)	3858 (52.2)	1562 (52.2)
Worse than 2001 (n=3843)	2511	432	2943 (38.0)	558 (34.9)	342 (32.5)	2732 (36.9)	1102 (36.8)
					χ^2 = 20.0, p<0.001		χ2 = 0.07, p=0.97

Source: Mexican Health and Aging Study, 2001 & 2003. Notes: a. Up to 2% of respondents have never seen a doctor, which means that they could not have been diagnosed with either hypertension or diabetes.

Table B.2. Simple analyses of discordant answers on retrospective reports of household sanitation facilities before age 10, at baseline (2001) and two-year follow-up (2003) for older Mexican adults (n=10,449)			
	OR		95% CI
Health Conditions, 2001-2003			
Diabetes in 2001	0.91		(0.79, 1.06)
Hypertension in 2001	0.92		(0.81, 1.04)
Five or more depressive symptoms in 2001	0.98		(0.95, 1.00)
Five or more depressive symptoms in 2003	0.94	***	(0.92, 0.96)
Change in number of depressive symptoms	0.97	**	(0.95, 0.99)
Worse self-rated health in 2003 compared to 2001 (Ref = Same or better health in 2003)	0.8	**	(0.70, 0.92)
Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.001			

Table B.3. Simple analyses of discordant answers on retrospective reports of mother's education at baseline (2001) and two-year follow-up (2003) for older Mexican adults (n=10,449)			
	OR		95% CI
Health Conditions, 2001-2003			
Diabetes in 2001	1.02		(0.93, 1.12)
Hypertension in 2001	0.94		(0.87, 1.02)
Five or more depressive symptoms in 2001	0.95		(0.87, 1.04)
Five or more depressive symptoms in 2003	1.06		(0.97, 1.16)
Change in number of depressive symptoms	1.01		(0.99, 1.02)
Worse self-rated health in 2003 compared to 2001 (Ref = Same or better health in 2003)	0.99		(0.91, 1.08)
Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.001			

Table B.4. Multivariable model of discordant answers on retrospective reports of household sanitation facilities before age 10, at baseline (2001) and two-year follow-up (2003) for older Mexican adults (n=10,449)

		OR		95% CI	OR		95% CI	OR		95% CI
Female		1.00		(0.88, 1.14)	1.02		(0.87, 1.17)	0.99		(0.88, 1.14)
Age[a]										
	55-59	0.89		(0.74, 1.07)	0.89		(0.74, 1.06)	0.88		(0.74, 1.06)
	60-69	0.89		(0.75, 1.07)	0.89		(0.75, 1.07)	0.88		(0.74, 1.05)
	70+	0.90		(0.74, 1.10)	0.90		(0.74, 1.10)	0.89		(0.73, 1.09)
Urban residence		1.74	***	(1.49, 2.03)	1.74	***	(1.49, 2.03)	1.75	***	(1.50, 2.04)
High out-migration state		1.38	***	(1.21, 1.58)	1.39	***	(1.21, 1.59)	1.38	***	(1.20, 1.58)
No education		0.61	***	(0.51, 0.73)	0.61	***	(0.51, 0.74)	0.61	***	(0.51, 0.73)
Health Conditions, 2001-2003										
Worse self-rated health in 2003 compared to 2001[b]		0.88		(0.77, 1.01)						
Five or more depressive symptoms in 2003					0.84	*	(0.73, 0.96)			
Change in number of depressive symptoms								0.97	*	(0.95, 0.99)
LR Chi-squared		**139.2**	*******		**####**	*******		**138.5**	*******	

Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.001. Note: A. Ref= 50-54 years; B. Ref= Same or better health in 2003.

Table B.5. Multivariable model of discordant answers on retrospective reports of mother's educational attainment, at baseline (2001) and two-year follow-up (2003) for older Mexican adults (n=10,449)

	OR		95% CI	OR		95% CI	OR		95% CI
Female	0.92		(0.85, 1.01)	0.91	*	(0.83, 0.99)	0.93		(0.85, 1.01)
Age[a]									
55-59	1.11		(0.98, 1.26)	1.11		(0.98, 1.27)	1.11		(0.98, 1.26)
60-69	1.30	***	(1.15, 1.47)	1.29	***	(1.15, 1.46)	1.28	***	(1.13, 1.45)
70+	1.42	***	(1.24, 1.62)	1.41	***	(1.23, 1.62)	1.41	***	(1.24, 1.62)
Urban residence	0.98		(0.90, 1.08)	0.99		(0.90, 1.09)	0.99		(0.90, 1.09)
High out-migration state	1.09		(0.99, 1.20)	1.09		(0.99, 1.20)	1.10		(0.99, 1.21)
No education	0.74	***	(0.67, 0.83)	0.74	***	(0.66, 0.82)	0.75	***	(0.67, 0.83)
Health Conditions, 2001-2003									
Worse self-rated health in 2003 compared to 2001[b]	1.00		(0.91, 1.09)						
Five or more depressive symptoms in 2003				1.09		(0.99, 1.19)			
Change in number of depressive symptoms							1.01		(0.99, 1.02)
LR Chi-squared	**62.9**	*******		**66.7**	*******		**60.6**	*******	

Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.001. Note: A. Ref= 50-54 years; B. Ref= Same or better health in 2003.

Appendix C. Assessing Bias in Models Using Early-Life Predictors from 2003 MHAS

The MHAS added two indicators of early life health and socio-economic status in their follow-up sample in 2003 that are potential interest in estimating migration selectivity and later-life health as part of the analyses presented in this dissertation. The concern is that if I add these indicators, I limit the analysis to respondents who followed up with the survey in 2003. There were n=2017 respondents who completed the baseline survey in 2001, and did not follow up in 2003, and these are likely to be older, less healthy members of the baseline sample.

My models that did not account for this biased sample attrition when using these 2003 measures suggest that while the indicator of childhood hunger significantly predicts later-life health, it does not predict personal or spousal migration to the U.S. This means it is of limited use in models that assess early life conditions as indicators of U.S. migration selectivity, or test U.S. migration as a mediator in the relationship between early life conditions and later-life health. At the same time, while father's occupation predicts personal and spousal migration to the US, it for the most part does not significantly predict later-life health when controlling for other childhood indicators of socio-economic status and health. I therefore decided against using these measures for most of my analyses, which enabled me to use the entire 2001 baseline sample.

However, it is worth testing some of the significant results that I did report using this limited, 2003 follow-up sample with the added measures of childhood hunger and father's occupation. To account for this bias, I run these models with inverse probability weights, as

Huang, Soldo and Elo (2011) do in their analysis of early-life SES and health and later-life physical functioning using the 2003 MHAS. The inverse probability weights involve estimating the probability, *p*, of being included in the 2003 MHAS with characteristics that were observed in 2001, including age, residence characteristics, marital status, childhood and adult socio-economic status, and 2001 self-rated health, chronic health conditions, and depression. Regression models are then weighted with the inverse of these probability estimates (1/*p*) in order to give greater weight to 2003 cases that are more like those individuals that did not make it to the follow-up survey based on demographics, health, and socio-economic status.

The overwhelming finding from these sensitivity analyses is that there are no real changes to the qualitative results when adjusting for the attrition bias for the follow-up study. That is, there are significant relationships between childhood hunger and later-life health outcomes (Table C.1). But childhood hunger is not significantly associated with personal or spousal migration to the U.S. even when accounting for the attrition involved with using the follow-up sample that responded to the measure of childhood hunger (Table C.2).

I also confirmed my previous findings for father's occupation as a potentially useful indicator of migration selectivity *and* later-life health. Reporting agriculture as the primary paternal occupation is associated with significantly greater odds of both personal and spousal migration to the U.S., meaning that it could be a useful measure of migration selectivity (Table C.2). On the other hand, while father's occupation was a significant predictor of later-life health outcomes in some cases without any additional controls (Table C.1), these significant effects fell away almost entirely in multivariable models that controlled for other indicators of early childhood socio-economic and health indicators (Table C.3).

The main findings of interest from my dissertation use the childhood hunger measure in tests of interactions between early-life measures and personal or spousal US migration to the US. There was a significant multiplicative interaction between childhood hunger and US migration in the effect on depression for older Mexican men. In Chapter 6 I showed that US migration experience appeared to buffer the adverse effect of childhood hunger on later-life depression. I re-ran the analysis using the inverse probability weighting method and confirmed a similar result, although the magnitude of the buffering effect of US migration was smaller than what I found without the inverse probability weighting (Table C.4).

There were also significant additive interactions between childhood hunger and US spousal migration in the effect on hypertension and depression. These findings suggested that spousal migration to the U.S. exacerbated the adverse impact of childhood hunger on later-life hypertension and depression. I retested these effects with inverse probability weights and did find that there were no longer significant additive interaction effects between childhood hunger and spousal migration to the U.S. on each of these later-life health outcomes (not shown). This discrepancy highlights the importance of re-testing results that limit the analytic sample to the younger, healthier pool of respondents that completed follow-up interviews in 2003, two years after baseline. They also underscore my qualitative assessment of weak results for significant interactions between early-life conditions and U.S. migration in the effect on later-life health outcomes. For completeness, I re-ran all other interaction effects between personal and spousal migration to the U.S., and childhood hunger and father's occupation. I did not find any additional significant interaction terms when applying the inverse probability weights (not shown).

Overall, the findings of this sensitivity analyses mostly confirm the main findings from the dissertation, and show that there are very minor differences in the size of effects in some cases when restricting to the slightly younger, healthier two-year follow-up sample. On the other hand, the indicators of early-life socio-economic status and health added in the 2003 sample each have substantial drawbacks when it comes to estimating both U.S. migration selectivity and later-life health. Given these drawbacks, the potential bias created by using these measures and consequently restricting the sample may not be worth the gain of adding two additional indicators of early-life SES and health.

Table C.1. Simple models of later-life health outcomes regressed on by indicators of childhood health and socio-economic status for older Mexican adults using inverse probability weights.

	Depressive Symptoms - Continuous			**Depression - Binary**			**Diabetes**			**Hypertension**		
Men	B		SE	OR		95% CI	OR		95% CI	OR		95% CI
Childhood hunger	1.08	***	(0.11)	0.39	***	(0.07)	0.39	***	(0.07)	0.21	**	(0.08)
Father's in agricultural occupation	0.65	***	(0.10)	0.56	***	(0.10)	0.57	***	(0.10)	0.51	***	(0.10)
Women												
Childhood hunger	1.45	***	(0.08)	0.3	***	(0.07)	0.30	***	(0.07)	0.14		(0.07)
Father's in agricultural occupation	0.62	***	(0.08)	0.20		(0.12)	0.20		(0.12)	0.08		(0.11)

Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.001. Notes: a. Controlling for lifetime occupational status (agricultural/domestic versus other), number of items in R's household, ranging from 0-6 items, and poor self-rated economic status.

Table C.2. Simple models of later-life health outcomes regressed on by indicators of childhood health and socio-economic status for older Mexican adults using inverse probability weights.						
		Return US migrant			**Spousal migration to US**	
Men	B		SE	OR		95% CI
Childhood hunger	1.08	***	(0.11)	0.39	***	(0.07)
Father's in agricultural occupation	0.65	***	(0.10)	0.56	***	(0.10)
Women						
Childhood hunger	1.45	***	(0.08)	0.3	***	(0.07)
Father's in agricultural occupation	0.62	***	(0.08)	0.20		(0.12)

Source: Mexican Health and Aging Study, 2001 and 2003 *p<0.05, **p<0.01, ***p<0.001. Notes: a. Controlling for lifetime occupational status (agricultural/domestic versus other), number of items in R's household, ranging from 0-6 items, and poor self-rated economic status.

Table C.3. Multivariable logistic regression models of depression for older Mexican men by indicators of childhood health and socio-economic status (n=5567)				
			(n=6755)	
2001 Characteristics		B		SE
No sanitation facilities before age 10		0.78	***	(0.07)
Serious illness before age 10		0.75	***	(0.11)
R has no education		0.75	***	(0.07)
Mother has no education		0.64	***	(0.07)
	Don't know mother's education	0.57	***	(0.12)
2003 Characteristics			**(n=5806)**	
Father's occupation (Ref = Agriculture)				
	Construction	-0.34	**	(0.11)
	Garden	-0.60	***	(0.13)
	Restaurant	-0.61	***	(0.14)
	Office or other	-0.60	***	(0.13)
	No parent/don't know	0.09		(0.15)
Frequently went to bed hungry before age 10		1.42	***	(0.07)

Source: Mexican Health and Aging Study, 2001 and 2003, *p<0.05, **p<0.01, ***p<0.001

Table C.4. Logistic regression model of depression for older Mexican men with interaction between childhood hunger and US migration history (n=4585)[a]

		OR		95% CI
Frequent hunger before age 10		0.14	***	(0.11, 0.17)
Return US migrant		0.04	*	(0.01, 0.08)
	Frequent hunger*return US migrant	-0.09	*	(-0.16, -0.01)

Source: Mexican Health and Aging Study, 2003 *p<0.05, **p<0.01, ***p<0.00; Notes: a. controlling for age, residence characteristics, current marital status, and other childhood characteristics.

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