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Immigrant Status and Cognitive Functioning in Late Life: An Examination of Gender Variations in the Healthy Immigrant Effect

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Abstract

Although some research suggests that the healthy immigrant effect extends to cognitive functioning, it is unclear whether this general pattern varies according to gender. We use six waves of data collected from the original cohort of the Hispanic Established Populations for the Epidemiologic Study of the Elderly to estimate a series of linear growth curve models to assess variations in cognitive functioning trajectories by nativity status and age at migration to the U.S.A. among women and men. Our results show, among women and men, no differences in baseline cognitive status (intercepts) between early- (before age 20) and late-life (50 and older) immigrants and U.S.-born individuals of Mexican-origin. We also find, among women and men, that middle-life (between the ages of 20 and 49) immigrants tend to exhibit higher levels of baseline cognitive functioning than the U.S.-born. Our growth curve analyses suggest that the cognitive functioning trajectories (slopes) of women do not vary according to nativity status and age at migration. The cognitive functioning trajectories of early- and late-life immigrant men are also similar to those of U.S.-born men; however, those men who migrated in middle-life tend to exhibit slower rates of cognitive decline. A statistically significant interaction term suggests that the pattern for middle-life migration is more pronounced for men (or attenuated for women). In other words, although women and men who migrated in middle-life exhibit higher levels of baseline cognitive functioning, immigrant men tend to maintain this advantage for a longer period of time. Taken together, these patterns confirm that gender is an important conditioning factor in the association between immigrant status and cognitive functioning.

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Keywords

USA; Immigration; Cognitive Functioning; Gender; Mexican American; Elderly

Introduction

Studies consistently find that people who immigrate to the United States of America (U.S.) are often healthier than their native-born counterparts. This “healthy immigrant effect” can be seen across a range of health-related outcomes, including, for example, drinking and smoking (Kimbrow, 2009; Lopez-Gonzalez et al., 2005), body mass (Antecol & Bedard, 2006; Hao & Kim, 2008), allostatic load (Kaestner et al., 2009; Peek et al., 2010), physical health (Cho et al., 2004; Jasso et al., 2004; Read & Reynolds, 2012), physical disability (Cho et al., 2004; Markides & Gerst, 2011), and mortality risk (Abraido-Lanza et al., 1999; Angel et al., 2010). Researchers speculate that immigrants are often found to be healthier because (a) the migration process requires good health (health selection), (b) immigrants in poor health return to countries of origin to die (salmon bias), and (c) immigrants tend to avoid risky health behaviors like drinking and smoking (healthy lifestyles) (Cunningham et al., 2008; Franzini et al., 2001; Jasso et al., 2004; Lopez-Gonzalez et al., 2005).

Although immigrants are initially healthier than non-immigrants upon arrival, this apparent health advantage tends to wane with length of residence in the U.S. (Antecol & Bedard, 2006; Lopez-Gonzalez et al., 2005; Vega & Amaro, 1994). Studies suggest that the health of immigrants tends to converge with the health of the native-born population because (a) the process of acquiring new cultural elements like language and work is often extremely difficult and demanding (acculturative stress), (b) immigrants tend to live and work in substandard conditions (hazardous environments), and (c) U.S. culture and the stress of acculturation and hazardous environments often encourages the adoption of risky health behaviors like smoking and poor eating habits (unhealthy assimilation) (Cunningham et al., 2008; Kaestner et al., 2009; Markides & Gerst, 2011; Vega & Amaro, 1994).

Although previous studies have made significant contributions, additional research is needed to explore connections between immigrant status and understudied outcomes like cognitive functioning (Hill et al., 2012). While some studies suggest that the healthy immigrant effect may extend to indicators of cognitive functioning, including orientation, attention, memory, language, and reasoning (Kopeck et al., 2001; Hill et al., 2012), other reports show no apparent immigrant advantage (Collins et al., 2009; Haan et al., 2011; Miranda et al., 2009; Nguyen et al., 2002; Sachs-Ericsson et al., 2009; Sheffield & Peek, 2009). To date, researchers have also neglected to consider whether gender might moderate the association between immigrant status and cognitive functioning (Hill et al., 2012). This omission is important because women and men tend to migrate for different reasons and experience migration in unique ways (Curran, 2006; Donato, 2010; Suarez-Orozco & Qin, 2006). In fact, Suarez-Orozco and Qin (2006) call for future studies of psychological outcomes to “tease out different scenarios of gender dynamics and migration adaptation” (p. 184).

Building on previous work, we consider whether the cognitive functioning trajectories of older Mexican Americans vary according to nativity status and age at migration among

women and men. We emphasize older Mexican Americans because they represent one of the largest and fastest growing populations in the U.S. (Angel & Whitfield, 2007). In the pages that follow, we review previous studies of immigrant status and cognitive functioning and present a rationale for gender variations in the healthy immigrant effect. After describing our data, measures, and statistical procedures, we summarize the key results of our longitudinal analysis. We conclude with a discussion of our key findings, study limitations, and viable avenues for future research.

Background

Immigrant status and cognitive functioning

Kopeck and colleagues (2001) were among the first to consider whether the healthy immigrant effect might extend to cognitive functioning. Their analysis of cross-sectional data from the Canadian *National Population Health Survey* reveals lower rates of cognitive dysfunction among non-English-speaking Hispanic and African immigrants (born in the U.S., Mexico, Europe, South/Central America, or Africa) than among Canadian-born English-speaking Canadians. Interestingly enough, the apparent cognitive advantages of immigration did not extend to English-speaking immigrants (born in the U.S., Mexico, Europe, or Australia), non-English-speaking European immigrants (born in Europe or Australia), or non-English-speaking Asian immigrants.

Studies conducted in the U.S. also reveal a mix of inconsistent patterns. In their analysis of longitudinal data from the first and third waves of the Hispanic Established Populations for the Epidemiologic Study of the Elderly (H-EPESE), Nguyen and colleagues (2002) report no differences in the rate of cognitive decline between Mexican immigrants to the U.S. and U.S.-born natives of Mexican descent. Several subsequent studies have replicated the work of Nguyen and colleagues (2002) through the first four waves of the H-EPESE (Collins et al., 2009; Miranda et al., 2009; Sachs-Ericsson et al., 2009; Sheffield & Peek, 2009). Contrary to most studies of immigrant health convergence, Gonzalez and colleagues' (2009) analysis of cross-sectional data from the first wave of the H-EPESE shows that, among Mexican immigrants, more years of U.S. residency is associated with higher levels of cognitive functioning.

Haan and colleagues (Haan et al., 2011) provide recent evidence to suggest that Mexican immigrants may actually have poorer cognitive functioning than their U.S.-born counterparts. Using data from the *Sacramento Area Latino Study on Aging* (SALSA), these authors report that Mexican immigrants with Mexico-born parents and grandparents tend to exhibit lower levels of cognitive functioning than Mexican Americans with Mexico-born parents and grandparents (first and second generations) and similar levels of cognitive functioning when compared to Mexican Americans with U.S.-born parents and grandparents (third generation).

Finally, Hill and colleagues (Hill et al., 2012) used six waves of H-EPESE data to assess variations in cognitive functioning trajectories by nativity status *and* age at migration. They reported that the baseline cognitive status and cognitive functioning trajectories of early- (before age 20) and late-life (50 and older) immigrants are similar to those of the U.S.-born.

Hill et al. also found that those who migrated in middle-life (between the ages of 20 and 49) tended to exhibit higher levels of baseline cognitive functioning and slower rates of cognitive decline than the U.S.-born. Hill and colleagues (Hill et al., 2012) speculate that these cognitive advantages reflect immigrant growth processes that are generated by the unique cognitive demands of migration in middle-life. We explore this idea in greater detail and in the context of gender variations in our final discussion section.

Gender variations in the healthy immigrant effect

Studies consistently show that the rate at which the health of immigrants converges with the native-born population tends to vary by gender, with immigrant men maintaining their health advantages for longer periods of time. This general pattern is constant across several health-related outcomes, including drinking and smoking (Abraido-Lanza et al., 2005; Lara et al., 2005; Lopez-Gonzalez et al., 2005; Perez-Stable et al., 2001), illicit drug use (Lara et al., 2005), body mass (Abraido-Lanza et al., 2005; Antecol & Bedard, 2006; Hao & Kim, 2008), disability (Markides & Gerst, 2011), self-rated health and hypertension (Read & Reynolds, 2012). Although most studies show that immigrant men are advantaged relative to immigrant women, this pattern is not uniform. While some research suggests that convergence for smoking and binge drinking is similar for women and men (Kimbrow, 2009), others find that the association between acculturation and chronic conditions is more pronounced among men (Gorman et al., 2010). Nevertheless, Lara and colleagues (2005) conclude that “Highly acculturated Latinas are a group with significant potential for risk reduction, on the basis of the stronger relative effects of acculturation on unhealthy behaviors and outcomes in women as compared with men” (p. 384).

Why might the healthy immigrant effect tend to favor men? The process of immigration is stressful for women and men, but it may be especially stressful for women. Initially, stress could stem from a lack of control over the decision to immigrate. According to Salgado de Snyder (1987), “females who migrate to the United States are likely to migrate as members of a whole family together, or as dependents of males who have already established permanent residency” (p. 477). Because women can be pressured to leave their native countries as “secondary” immigrants (Donato, 2010; Kanaiaupuni, 2000), they are more likely to view the immigration process as an especially undesirable or stressful life change (Salgado de Snyder, 1987).

Stress may also follow from “cultural dissonance” or conflicts between one's native culture and U.S. culture (Suarez-Orozco & Qin, 2006; Vega & Rumbaut, 1991; Vega & Amaro, 1994). Although men tend to migrate to find employment, traditional gender roles in Mexico encourage women to elevate family obligations over socioeconomic pursuits and to migrate according to family interests (Gorman et al., 2010; Kanaiaupuni, 2000). In the US, however, women are increasingly expected to go to school, to find work, and to contribute financially. Cultural dissonance may arise when immigrant women are persuaded to leave the home in order to meet these expectations.

Over time, the stress associated with difficult immigration and acculturation experiences could undermine cognitive functioning through physiological mechanisms. Compulsory immigration, unwanted life changes, and the constant struggle to manage seemingly

contradictory cultural expectations could contribute to allostatic load or chronic activation of the physiological stress response. We highlight this process because research suggests that overexposure to stress hormones may be sufficient to disrupt or even damage the hippocampus, a region of the brain that regulates memory, orientation, and, by extension, the rate of cognitive decline (McEwen & Sapolsky, 1995; McEwen, 2002). Although studies show that acculturation is associated with increased allostatic load in the Mexican population (Kaestner et al., 2009; Peek et al., 2010), it is unclear whether this pattern is more pronounced among immigrant women. While stress may be a viable explanation for gender variations in the healthy immigrant effect, we are unable to examine this process in the current study. We present this theory to support the likelihood of gender variations.

Hypotheses

Drawing on this background, we developed the following hypotheses to guide subsequent analyses. Hypothesis 1: Mexican immigrant women and men will tend to exhibit better baseline cognitive functioning and a slower rate of cognitive decline than their native-born counterparts. Hypothesis 2: The healthy immigrant effect will be more pronounced with increasing age at migration. Hypothesis 3: The healthy immigrant effect will be more pronounced for men. In other words, immigrant men will tend to maintain their cognitive advantage for a longer period of time.

Methods

Data

Subsequent analyses employ six waves of data collected from the original cohort of the Hispanic Established Populations for the Epidemiologic Study of the Elderly (H-EPESE) (<http://www.icpsr.umich.edu/icpsrweb/ICPSR/studies/2851/detail>). The H-EPESE survey is based on a probability sample of 3,050 Mexican Americans aged 65 and older who reside in Texas, California, New Mexico, Arizona, and Colorado. Respondents were surveyed in 1993-1994, 1995-1996, 1998-1999, 2000-2001, 2004-2005, and 2007. The response rate at baseline was 86%. The surveys included detailed information on health and disability, immigration history, and demographic characteristics. Note that we have omitted proxy respondents (n = 316) from the analytic sample due to missing or invalid responses on the dependent variable. Our gender-specific samples included a total of 1,589 women and 1,145 men. Due to non-response and death, our final analytic samples were reduced to 1,348 women and 978 men.

Measurement of nativity and age at migration

Following previous research (Angel et al., 2008; 2009; 2010; Hill et al., 2012), we created four nativity status and age at migration groups of Mexican Americans. Group 1 represents those who were born in the US, Group 2 represents those who were born in Mexico and migrated to the U.S. before the age of 20, Group 3 represents those who were born in Mexico and migrated to the U.S. between the ages of 20 and 49 years, and Group 4 represents those who were born in Mexico and migrated to the U.S. between the ages of 50 and 90 years. In our main analysis, U.S.-born Mexican Americans (Group 1) serve as the reference category against which the Mexico-born groups (Groups 2-4) are compared.

Measurement of health and disability

We used the Mini-Mental State Examination (MMSE) to measure *cognitive functioning*. The MMSE is one of the most commonly used cognitive screening devices in studies of older adults. It represents a brief, standardized method by which to grade cognitive status (Folstein et al., 1975). It measures responses to a standard battery of memory and reasoning items and assesses orientation, attention, immediate and short-term recall, language, and the ability to follow simple verbal and written commands. The MMSE provides correct classification rates between 80% and 90% when compared with physician diagnoses of cognitive impairment and dementia (Tombaugh & McIntyre, 1992). The English and Spanish versions were drawn from the Diagnostic Interview Scale (Bird et al., 1987). The Spanish version conforms to standard criteria, including formal translation, back-translation, and consensus by committee for final content (Black et al., 1999) and has been used in several studies of older Mexican Americans (Black et al., 1999; Haan & Weldon, 1996; Hill et al., 2006; Nguyen et al., 2002; Wu et al., 2003). We acknowledge that most studies make use of conventional thresholds in the measurement of cognitive functioning. For example, Black and colleagues (1999) used MMSE scores below 18 and between 18 and 23 to reflect severe cognitive impairment and mild cognitive impairment, respectively. Following recent research (Collins et al., 2009; Hill et al., 2006; Hill et al., 2012), we used the continuous specification of MMSE scores to directly estimate growth parameters or cognitive functioning trajectories.

Given that *depression* is associated with cognitive decline (Black et al., 1999; Nguyen et al., 2002; Sachs-Ericsson et al., 2009; Wu et al., 2003), we used the Center for Epidemiologic Studies Depression scale (CES-D) to measure depressive symptoms. The CES-D measures responses to 20 items (Radloff, 1977). Respondents were asked to indicate the frequency of depressive symptoms experienced in the past week. We coded the original response categories for these items as (1) rarely or none of the time, (2) some of the time, (3) occasionally, and (4) most or all of the time. The final CES-D measure represents a summed index of the 20 items.

Previous studies have also found that *smoking* and *drinking* are significant correlates of cognitive functioning (Collins et al., 2009; Haan & Wallace, 2004; Herbert et al., 1993). Accordingly, we measured smoking behavior with a single item. Respondents were asked, "Do you smoke cigarettes now?" We also measured drinking behavior with a single item. Respondents were asked, "In the past month, have you had any beer, wine, or liquor?" We coded response categories for these items as (1) for yes and as (0) otherwise.

A number of *chronic conditions* have been identified as significant risk factors for cognitive decline, including diabetes (Haan et al., 2011; Nguyen et al., 2002; Wu et al., 2003), hypertension (Swan et al., 1998; Birkenhager et al., 2001), stroke (Black et al., 1999; Haan et al., 2011; Nguyen et al., 2002), and heart attack (Tilvis et al., 2004). Our measures of diabetes, stroke and heart attack conditions are based on self-reports. Respondents were asked to indicate whether they had ever been told by a doctor that they had any of the aforementioned conditions. We coded response categories for these items as (1) for yes and as (0) otherwise. Blood pressure was directly measured by standard mercury

sphygmomanometer. Two readings were taken for each respondent, and an average systolic and diastolic blood pressure was calculated. We coded respondents as positive for hypertension if their average systolic reading was 140 mmHg or higher or their average diastolic reading was 90 mmHg or higher (Chobanian et al., 2003).

Research shows that *disability* is associated with lower levels of cognitive functioning (Zarit et al., 1995). With this concern in mind, subsequent analyses control for activities of daily living (ADLs) at baseline (Katz et al., 1963). We measured ADLs with seven items. Respondents were asked to indicate whether they could do any of the following activities by themselves or without any help from anyone else: (a) walk across a small room, (b) take a bath or shower, (c) perform personal grooming, (d) dress, (e) eat, (f) get from a bed to a chair, and (g) use the toilet. We coded respondents as (1) if they needed help or were unable to accomplish any of the seven activities and as (0) otherwise.

Measurement of background factors

Several background factors have been identified as significant correlates of cognitive functioning (Angel et al., 2003; Black et al., 1999; Collins et al., 2009; Haan et al., 2011; Hill et al., 2006; Miranda et al., 2009; Mulgrew et al., 1999; Nguyen et al., 2002; Sachs-Ericsson et al., 2009). In accordance with this research, subsequent analyses include controls for age, education, financial strain, and English language proficiency.

Age is a continuous variable, ranging from (65) to (107). *Education* is coded as (1) for high school diploma or greater and as (0) otherwise. *Financial strain* was measured with two items. Respondents were asked, “How much difficulty do you have in meeting monthly payments on your bills?” Response categories for this item were coded (1) none, (2) a little, (3) some, and (4) a great deal. Respondents were also asked, “At the end of the month, do you usually end up with some money left over, just enough to make ends meet, or not enough to make ends meet?” Response categories for this item were coded (1) some money left over, (2) just enough to make ends meet, and (3) not enough money to make ends meet. We measured financial strain as the mean response to these two items. These items were standardized to account for metric differences.

We measured *English language proficiency* with three items. Respondents were asked, “In your opinion, how well do you (a) understand spoken English, (b) speak English, and (c) read English?” The original response categories for these items ranged from (1) not at all to (4) very well. The final language proficiency measure represented the mean response to these three items.

Statistical procedures

We use linear growth curve modeling to describe and predict cognitive functioning trajectories over the fourteen year study period. Standard lagged endogenous dependent variable models are well suited to predict changes in cognitive functioning over two points in time; however, these kinds of models are limited to indirect assessments of change across three or more waves. In contrast, growth curve analysis may directly describe and explain individual change over several waves of data (Bryk & Raudenbush, 1987; Raudenbush &

Bryk, 2002). In the present study, we use hierarchical linear modeling (HLM) to estimate and predict individual growth curves. Growth curve analysis represents a two-stage model of change. In the first stage, an individual's repeated measures (e.g., MMSE scores) are modeled as a function of an individual growth trajectory. In the second stage, individual growth trajectories are permitted to vary as a function of individual background characteristics (e.g., nativity status and age at migration).

Our specific multivariate analytic strategy proceeds in two steps. In the first step, we model baseline cognitive functioning scores to assess whether initial cognitive status varies according to immigrant status. This intercept analysis includes two regression models for women and men. Model 1 tests whether immigrant status is associated with cognitive functioning at baseline, net of all background factors. Model 2 adds health and disability factors to Model 1 to assess any changes in the association between immigrant status and cognitive functioning that might be linked to health selection or mediation processes. Factors related to health and disability may contribute to health selection or mediation (e.g., through smoking). Either process would theoretically attenuate any cognitive advantages among immigrants. Because Model 2 adds potential mediator and selection variables, the primary interpretation of our regression results should be based on Model 1. In the second step, we model cognitive functioning trajectories to assess whether the rate of cognitive decline varies according to immigrant status. This slope analysis follows the same two-model strategy used in our intercept analysis.

Supplemental attrition analysis

When considering outcomes over time, it is customary to examine the issue of sample attrition. Our full analytic samples included 1,589 women and 1,145 men. Our final analytic samples lost 241 women (15%) and 167 men (14%) due to non-response and death. The primary concern is whether there is any systematic attrition. To formally assess this issue, we estimated a series of binary logistic regression models predicting the log odds of non-response to the MMSE and death at each wave (results not shown). In these analyses, the dependent variables were dummy-coded such that respondents who were missing on the MMSE and deceased (respectively) were given a value of one, and those who completed the MMSE and survived (respectively) were given a value of zero. The independent variables included all baseline predictors. For women and men, poor health (e.g., diabetes and poorer cognitive functioning), disability, and old age were largely responsible for attrition due to non-response and death. These patterns are generally consistent with a recent study of the first five waves of the H-EPESE (Stimpson & Ray, 2010). Because we employ full maximum likelihood estimation and control for factors that predict the odds of non-response and death, sample attrition due to observed predictor variables is unlikely to bias our regression coefficients (Raudenbush & Bryk, 2002; Stimpson & Ray, 2010). We consider the potential for bias due to attrition from unobserved variables in our final discussion section.

Results

Descriptive analysis

Table 1 provides baseline descriptive statistics for selected study variables for women and men. With respect to nativity status and age at migration, the sample includes those born in the U.S. (Women: 57% and Men: 55%) and those who immigrated in early- (Women: 14% and Men: 14%), middle- (Women: 20% and Men: 22%), and late-life (Women: 9% and Men: 9%). Women and men tended to exhibit high levels of cognitive functioning and low levels of depression. We also observed low to moderate rates of smoking (Women: 9% and Men: 19%) and drinking (Women: 6% and Men: 30%). Problems with physical health range from low levels of stroke (Women: 4% and Men: 6%) to high levels of hypertension (Women: 43% and Men: 42%). Finally, women and men were, on average, 72 years of age, with low levels of education and moderate levels of financial strain and English language proficiency.

Table 1 also indicates statistically significant mean differences between women and men across selected study variables at baseline. Women tended to exhibit higher levels of depression and lower rates of smoking, drinking, and heart attack. There was also some evidence to suggest that men have higher levels of English language proficiency. We observed no baseline gender differences in immigrant status, cognitive functioning, diabetes, hypertension, stroke, disability, age, education, and financial strain.

Regression of baseline cognitive functioning

Table 2 provides multivariate regression estimates (intercept and slope) for women, and Table 3 presents multivariate regression estimates (intercept and slope) for men. Model 1 in Tables 2 and 3 estimate a conditional intercept model to test whether baseline cognitive functioning varies according to nativity status and age at migration, net of controls for background factors. These results showed, among women and men, no differences in baseline cognitive status between early-(before age 20) and late-life immigrants (50 and older) and the U.S.-born. We also observed, among women and men, that those who migrated between the ages of 20 and 49 tended to exhibit higher levels of baseline cognitive functioning than the U.S.-born. These general patterns persisted with adjustments for health and disability in Model 2 (Tables 2 and 3).

Although middle life migration was associated with higher levels of baseline cognitive functioning among women and men, it was unclear whether the magnitude of this association varies according to gender. We formally assessed this issue by testing interaction terms (nativity/age at migration*gender) in the full sample (results not shown). Because none of the interaction terms reached statistical significance ($p > 0.10$), we concluded that the association between middle-life migration and baseline cognitive functioning was comparable for women and men.

Regression of cognitive functioning trajectories

Tables 2 and 3 also present the results of our primary growth curve analysis for women and men. Model 3 in Tables 2 and 3 estimated a conditional growth model to test whether

individual slopes or growth rates vary according to nativity status and age at migration, net of controls for baseline background factors. These results suggested that the cognitive functioning trajectories of women do not vary according to nativity status and age at migration. We also observed that the results for men are generally consistent with the patterns presented in Models 1 and 2. The cognitive functioning trajectories of early- (before age 20) and late-life immigrant (50 and older) men were similar to those of U.S.-born men, while those men who migrated between the ages of 20 and 49 tend to exhibit a slower rate of cognitive decline than U.S.-born men. These general patterns also persisted with adjustments for health and disability in Model 4 (Tables 2 and 3). Figure 1 provides a graphical illustration of the significant nativity status and age at migration pattern for men.

Once again, we formally tested whether the magnitude of the association between nativity/age at migration and cognitive functioning varies according to gender (results not shown). The results of this analysis suggested that associations with early- and late-life migration are similar for women and men. We also observed a statistically significant interaction term for middle-life migration ($b = -0.53$, $p < 0.05$). Because the interaction term was negative, the association between middle life migration and cognitive functioning was more pronounced for men (or attenuated for women).

Ancillary patterns

Although we are not primarily concerned with associations for health, disability, and background factors, we would like to briefly interpret several statistically significant patterns. According to Models 1 and 2 of Tables 2 and 3, among women and men, older age, financial strain, hypertension, and having at least one activity limitation was associated with lower levels of baseline cognitive functioning, while having at least a high school diploma and greater English language proficiency was associated with higher levels of baseline cognitive functioning. According to Models 3 and 4 of Tables 2 and 3, among women and men, older age, diabetes, and having at least one activity limitation was associated with faster rates of cognitive decline, while higher levels of baseline cognitive functioning and English language proficiency were associated with slower rates of cognitive decline.

Discussion

Although previous studies have made significant contributions to our understanding of immigration and health, it is unclear whether the healthy immigrant effect extends to cognitive functioning in late life. Researchers have also neglected to consider whether gender might moderate the association between immigrant status and cognitive functioning. Building on previous work, we tested whether the cognitive functioning trajectories of older Mexican Americans vary according to nativity status and age at migration for women and men.

Key results

Our first hypothesis stated that Mexican immigrant women and men would tend to exhibit better baseline cognitive functioning and a slower rate of cognitive decline than their native-born counterparts. This hypothesis received mixed support. Although women and men who

migrated in middle-life (between the ages of 20 and 49) tended to exhibit higher levels of baseline cognitive functioning than the U.S.-born, only men who migrated in middle-life tended to exhibit a slower rate of cognitive decline. These patterns are generally consistent with previous studies that document a healthy immigrant effect (Abraido-Lanza et al., 1999; Jasso et al., 2004; Kopec et al., 2001; Markides & Gerst, 2011; Peek et al., 2010). Because we are the first to consider variations by nativity status *and* age at migration *and* gender, it is difficult to compare our results with other studies of cognitive functioning. Nevertheless, our findings tend to support previous research that shows lower rates of cognitive dysfunction among Hispanics who immigrate to Canada (Kopec et al., 2001). More specifically, the present study replicates noted cognitive advantages among Mexicans who immigrate to the U.S. in middle-life (Hill, Angel, & Balistreri, 2012).

Our second hypothesis stated that the healthy immigrant effect would be more pronounced with increasing age at migration. This hypothesis also garnered partial support. Healthy immigrant studies usually report a declining health advantage with length of residence in the U.S. (Antecol & Bedard, 2006; Lopez-Gonzalez et al., 2005; Vega & Amaro, 1994). Yet, Gonzalez and colleagues (2009) find that, among Mexican immigrants to the US, more years of U.S. residency is associated with better average cognitive functioning. Consistent with the work of Hill and colleagues (2012), our results suggest that the health-convergence process could be non-linear, with the greatest cognitive advantages accruing to those who migrated in middle-life.

Our third hypothesis stated that the healthy immigrant effect would be more pronounced for men. Our results support this hypothesis. Although the cognitive functioning trajectories of women do not appear to vary according to nativity status and age at migration, men who migrated in middle-life tend to exhibit a slower rate of cognitive decline than U.S.-born men. These gendered patterns are striking because women and men who migrated in middle-life are similarly advantaged at baseline in terms of cognitive status. Immigrant men simply tended to maintain their apparent cognitive advantage for a longer period of time. These results specify that the general finding presented by Hill and colleagues (2012) is entirely driven by men and does not apply to women. Our data also support a growing body of evidence that documents a pattern of gendered immigrant health convergence (Abraido-Lanza et al., 2005; Antecol & Bedard, 2006; Hao & Kim, 2008; Lara et al., 2005; Lopez-Gonzalez et al., 2005; Markides & Gerst, 2011; Perez-Stable et al., 2001).

Why might middle-life immigrants tend to exhibit better cognitive functioning than the U.S.-born? Researchers often reference negative acculturation processes to explain why the healthy immigrant effect tends to wane with length of residence in the U.S. (Antecol & Bedard, 2006; Lopez-Gonzalez et al., 2005; Markides & Gerst, 2011; Vega & Amaro, 1994). For example, the act of migration itself is very stressful and often has negative psychosocial consequences as immigrants become socially and economically integrated into U.S. society (Kasl & Berkman, 1983; Rogler, 1994). However, Gonzalez and colleagues (2009) argue that “Acculturative stress is overdetermined (i.e., assumes a negative outcome) and cannot efficiently account for developmental changes in vulnerability that may cause positive outcomes in population health” (p. 1883). In others words, because processes related to acculturative stress are perhaps over-emphasized in the literature, very little is

known about processes related to immigrant growth or ways in which immigration might promote positive or healthy psychological development.

One promising explanation for the apparent advantages of middle-life immigrants points to positive growth processes stemming from the unique cognitive complexities of acculturation and adaptation to new social (developing new relationships), cultural (acquiring a second language), and economic (finding employment) systems (Glymour & Manly, 2008; Hill, Angel, & Balistreri, 2012; Schachter et al., 2012). Middle-life migration occurs during a period of the life course that is defined by independence, productivity, and status attainment, especially for immigrant men. Acculturation during this period of the life course is likely to present a unique combination of cognitive demands that should require an intense mobilization of mental faculties, which could favor healthy cognitive aging by maintaining dense neocortical synapses in the brain (Dixon et al., 2007; Stern, 2009, for a general discussion of cognitively stimulating experiences).

We must acknowledge that the acculturative stress perspective could help to explain why the cognitive functioning of early-life immigrants appears comparable to the U.S.-born. Repeated exposure to discrimination is often cited as a reason for stress and poor health among Mexican immigrants (Finch & Vega, 2003; Vega & Amaro, 1994). Acculturative stress may undermine the health of immigrants by increasing psychological distress and maladaptive behaviors (Dubowitz et al., 2010; Markides & Gerst, 2011; Vega & Amaro, 1994). Stress and risky health behaviors like smoking and drinking are important considerations because they are known to undermine cognitive functioning (Haan & Wallace, 2004; Herbert et al., 1993). Another explanation points to variations in the cognitive demands of early-life immigrants. Because early-life migrants are not immediately forced into adult roles, the cognitive complexities of acculturation and adaptation could be attenuated.

It is unclear why the cognitive status of late-life immigrants is comparable to the U.S.-born. The concept of linguistic isolation is one possible explanation. Glymour and Manly (2008) note that “Functioning in an English-speaking community may pose cognitive challenges, but also may serve to isolate adult or elderly immigrants who do not have the same opportunities or demands for mastering English as younger immigrants” (p. 229). Such a process could be significant because social engagement in late life is crucial for healthy cognitive aging (Dixon et al., 2007; Hill et al., 2006).

Study limitations

The present study has several limitations. Non-random attrition is always a major concern in longitudinal studies. Although attrition is unrelated to immigrant status (see also Stimpson & Ray, 2010), it is highly correlated with poor health, disability, and old age for women and men. Respondents with poorer cognitive functioning were especially likely to be lost to follow-up. This pattern limits the distribution of cognitive functioning scores and the external validity of our study.

We are also concerned with the possibility that our key results could be driven by processes related to gender-specific attrition. Because women often lack of control over the decision to

immigrate, they may be less selected on health than immigrant men. Women also have a survival advantage at every wave of the H-EPESE. This means that more unhealthy women immigrate and survive. It also suggests that men may appear healthier because only the healthiest immigrated and the least healthy were lost to follow-up.

Although we control for many correlates of attrition, we cannot rule out the potential for bias due to attrition from unobserved variables. Aside from our measurement of blood pressure, our analysis lacks direct indicators of chronic health conditions and physiological functioning (e.g., the stress response). Without these kinds of measurements, we are unable to examine a range of processes related to attrition, selection, and mediation.

Finally, we must acknowledge the limitations of our measurement of cognitive functioning. The MMSE has been shown to be a valuable screening instrument. However, the MMSE cannot be used to substitute for clinical diagnoses. Because the MMSE was designed to detect cognitive impairment, it can be insensitive to mild cognitive decline. Previous research also notes that the MMSE is susceptible to ceiling effects (Franco-Marina et al., 2010). According to our data, a high percentage of respondents who were born in the U.S. (Women: 21% and Men: 19%) and immigrated in early- (Women: 11% and Men: 14%), middle- (Women: 13% and Men: 15%), and late-life (Women: 5% and Men: 14%) reached the maximum MMSE score (30) at baseline. Although these patterns suggest the potential for ceiling effects, we must note that cognitive status tends to wane incrementally over the study period. In fact, by wave 6, a smaller percentage of respondents who were born in the U.S. (Women: 14% and Men: 12%) and immigrated in early- (Women: 2% and Men: 7%), middle- (Women: 7% and Men: 5%), and late-life (Women: 10% and Men: 0%) reached the maximum score.

Conclusion

In spite of these limitations, we are confident that the healthy immigrant effect extends to cognitive functioning among older Mexican Americans, especially men. Our work confirms that gender is an important conditioning factor in the association between immigrant status and cognitive functioning. With this in mind, additional research is needed to test whether the stress and cognitive stimulation processes that are referenced but not observed in the present study help to explain any gender variations. It is also important for future studies to assess the veracity and consistency of our results across indicators of cognitive functioning, including, for example, the Modified Mini-Mental State Examination (3MSE), the Spanish English Verbal Learning Test (SEVLT), and clinical measures of dementia and Alzheimer's disease. Work along these lines would provide a deeper understanding of gender variations in the healthy immigrant effect.

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Highlights

- We test whether cognitive functioning varies by nativity and age at migration for older Mexican American women and men.
- Women and men who migrated in middle-life tend to exhibit higher levels of baseline cognitive functioning than the US-born.
- However, only men who migrated in middle-life tend to exhibit a slower rate of cognitive decline.
- These patterns confirm that gender is an important conditioning factor in the association between immigrant status and cognitive functioning.

Figure 1.
Cognitive Functioning Trajectories by Nativity/Age at Migration (Men)

Table 1

Baseline Descriptive Statistics (H-EPESE, 1993)

	<u>Range</u>	<u>Mean</u>		<u>Standard Deviation</u>	
		Women	Men	Women	Men
Nativity/Age at Migration					
U.S.-born	0 - 1	0.57	0.55		
Immigrant (1-19)	0 - 1	0.14	0.14		
Immigrant (20-49)	0 - 1	0.20	0.22		
Immigrant (50-90)	0 - 1	0.09	0.09		
Health and Disability					
MMSE	13 - 30	25.38	25.51	3.73	3.68
CES-D	0 - 54	15.60	13.55*	7.99	6.54
Current Smoker	0 - 1	0.09	0.19* _g *		
Current Drinker	0 - 1	0.06	0.30*		
Diabetic	0 - 1	0.27	0.28		
Hypertensive	0 - 1	0.43*	0.42		
History of Stroke	0 - 1	0.04*	0.06		
History of Heart Attack	0 - 1	0.09	0.12*		
ADL (> 1)	0 - 1	0.10	0.09		
Background Factors					
Age	65 - 96	72.29	72.33	6.16	6.05
Education (> HS)	0 - 1	0.09	0.11		
Financial Strain	-1.51 - 1.51	0.05	-0.03	0.87	0.92
English Proficiency	1 - 4	2.26	2.37*	1.15	1.11

Notes: H-EPESE = Hispanic Established Populations for the Epidemiologic Study of the Elderly. Women ($n = 1,348$). Men ($n = 978$). Asterisks indicate statistically significant mean differences (

* $p < .05$, two-tailed t-tests) between women and men. MMSE = Mini-Mental State Exam. CES-D = Center for Epidemiologic-Depression Scale. ADL= activities of daily living. HS = High School.

Table 2

Regression of Cognitive Functioning – WOMEN (H-EPESE, 1993-2007)

Baseline Predictors	Intercept		Slope	
	Model 1	Model 2	Model 3	Model 4
Nativity/Age at Migration				
Immigrant (1-19)	.06 (–.49, .06)	.04 (–.51, .59)	.01 (–.36, .38)	.02 (–.35, .40)
Immigrant (20-49)	.90 (.41, 1.39) **	.89 (.40, 1.38) **	.09 (–.24, .41)	.04 (–.29, .37)
Immigrant (50-90)	.28 (–.42, .98)	.30 (–.40, .99)	–.01 (–.45, .45)	–.09 (–.53, .35)
Health and Disability				
MMSE				.15 (.12, .19) ***
CES-D		–.02 (–.04, .01)		–.01 (–.03, .01)
Current Smoker		–.05 (–.64, .54)		–.19 (–.58, .21)
Current Drinker		.08 (–.59, .74)		.21 (–.16, .58)
Diabetic		–.13 (–.52, .26)		–.34 (–.64, –.09) *
Hypertensive		–.38 (–.71, –.05) *		–.01 (–.23, .21)
History of Stroke		–.32 (–1.30, .66)		.05 (–.62, .73)
History of Heart Attack		.34 (–.25, .93)		–.23 (–.63, .17)
ADL (1)		–1.19 (–1.80, –.58) ***		–.53 (–1.06, –.01) *
Background Factors				
Age	–.13 (–.16, –.10) ***	–.12 (–.15, –.09) ***	–.14 (–.16, –.12) ***	–.13 (–.16, –.10) ***
Education (HS)	1.21 (.68, 1.74) ***	1.19 (.66, 1.72) ***	.04 (–.39, .47)	–.01 (–.43, .41)
Financial Strain	–.33 (–.53, –.13) **	–.25 (–.45, –.04) **	–.10 (–.24, .04)	–.02 (–.53, –.13)
English Proficiency	1.26 (1.08, 1.44) ***	1.25 (1.07, 1.43) ***	.18 (.06, .30) **	0.13 (1.08, 1.44) *

Notes: H-EPESE = Hispanic Established Populations for the Epidemiologic Study of the Elderly. $n = 1,348$. Shown are unstandardized regression coefficients and 95% confidence intervals.

ADLs =activities of daily living. CES-D = Center for Epidemiologic-Depression Scale. HS = High School.

*
p<.05

**
p<.01

p<.001.

Table 3

Regression of Cognitive Functioning – MEN (H-EPESE, 1993-2007)

Baseline Predictors	<u>Intercept</u>		<u>Slope</u>	
	Model 1	Model 2	Model 3	Model 4
Nativity/Age at Migration				
Immigrant (1-19)	.33 (–.30, .95)	.30 (–.32, .91)	–.02 (–.56, .52)	–.12 (–.64, .39)
Immigrant (20-49)	1.03 (.45, 1.61)**	1.01 (.43, 1.58)**	.64 (.27, 1.00)**	.64 (.27, 1.01)**
Immigrant (50-90)	–.16 (–.97, .65)	–.35 (–1.15, .46)	–.20 (–.82, .41)	–.31 (–.93, .31)
Health and Disability				
MMSE				.18 (.13, .22)***
CES-D		.01 (–.03, .03)		–.02 (–.04, .01)
Current Smoker		–.65 (–1.17, –.12)*		–.37 (–.81, .06)
Current Drinker		.42 (–.01, .85)		.27 (–.05, .59)
Diabetic		.31 (–.14, .76)		–.11 (–.45, –.23)*
Hypertensive		–.50 (–.91, –.10)*		–.05 (–.35, .26)
History of Stroke		–.54 (–1.45, .36)		–.66 (–1.42, .09)
History of Heart Attack		.17 (–.41, .74)		.16 (–.33, .65)
ADL (1)		–1.54 (–2.41, –.67)**		–.91 (–1.78, –.04)*
Background Factors				
Age	–.15 (–.18, –.11)***	–.13 (–.18, –.09)***	–.14 (–.04, –.02)***	–.12 (–.15, –.09)***
Education (HS)	1.22 (.55, 1.89)**	1.21 (.55, 1.87)**	.14 (–.46, .73)	.12 (–.47, .72)
Financial Strain	–.30 (–.53, –.07)	–.23 (–.53, .07)	–.17 (–.35, .01)	–.13 (–.30, .05)
English Proficiency	1.05 (.82, 1.28)***	1.02 (.78, 1.25)***	.23 (.07, .39)**	.15 (–.01, .32)

Notes: H-EPESE = Hispanic Established Populations for the Epidemiologic Study of the Elderly. $n = 978$. Shown are unstandardized regression coefficients and 95% confidence intervals.

ADLs = activities of daily living. CES-D = Center for Epidemiologic-Depression Scale. HS = High School.

*
p<.05

**
p<.01

p<.001.