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Age of Migration and the Incidence of Cognitive Impairment: A Cohort Study of Elder Mexican-Americans

Marc A. Garcia, PhD,[1,*] Adriana M. Reyes, PhD,[2] Brian Downer, PhD,[3] Joseph L. Saenz, PhD,[4] Rafael A. Samper-Ternent, MD, PhD,[5,1] and Mukaila Raji, MD, MS[1,5]

[1]University of Texas Medical Branch, Sealy Center on Aging, Galveston. [2]Population Studies Center, University of Michigan. [3]Division of Rehabilitation Sciences, University of Texas Medical Branch, Galveston. [4]University of Southern California, Davis School of Gerontology, Los Angeles. [5]Internal Medicine/Geriatrics, University of Texas Medical Branch, Galveston.

*Address correspondence to Marc A. Garcia, PhD, Sealy Center on Aging, 301 University Boulevard, University of Texas Medical Branch, Galveston, TX 77555-0177. E-mail: marcagar@utmb.edu

Abstract

Background and Objectives: To explore nativity and age of migration differentials in the incidence of cognitive impairment among older Mexican-Americans.

Research Design and Methods: We employ maximum-likelihood discrete time hazard models to estimate risk ratios of cognitive impairment in a sample of 2,708 Mexican-Americans 65 and older who were cognitively healthy at baseline over a follow-up period of up to 20 years.

Results: Late-life immigrant women have a 46% higher risk of cognitive impairment compared to U.S.-born Mexican-American women. Conversely, midlife immigrant men have a 29% lower risk of cognitive impairment compared to U.S.-born Mexican-American men. The incidence of cognitive impairment did not differ for early-life and midlife immigrant women relative to U.S.-born women or for early- and late-life immigrant men compared to U.S.-born men.

Discussion and Implications: Differences in cognitive impairment risk between U.S.-born and foreign-born Mexican-American subgroups may be partly due to health selectivity. Cognitive impairment is more prevalent among immigrant groups which may result in a higher burden on family members and/or high dependency on public resources. Programs are needed that can detect decline at earlier stages and reduce the risk for cognitive impairment among older immigrants entering their last decades of life.

Translational Significance: Mexican immigrants particularly midlife migrant males have social, cognitive, psychological, physical, and other health characteristics that confer resilience and longevity advantages on their entry into the United States. These advantages, which diminish with acculturation to American life, largely compensate for their poor socioeconomic profile. On the other hand, the high rate of cognitive impairment among late-life immigrant Mexican-American women underscores the need for researchers and policymakers to consider the impact of nativity status (United States vs foreign-born) and age of migration in the development of culture-appropriate interventions to slow cognitive disablement, lower caregiver burden, and reduce institutionalization and dependency on public resources.

Keywords: Cognitive aging, Cognition, Health disparities, Minority aging

Hispanics, of whom over 60% are Mexican-Americans, comprise one of the fastest growing groups of older adults in the United States (Stepler & Brown, 2016). From 2014 to 2060, the proportion of Hispanics age 65 years and older is projected to increase by 275% compared to a 29% decrease for non-Hispanics whites (Mather, Jacobsen, & Pollard, 2015). These projections are of public health importance as prior research indicates older Hispanics have a higher prevalence of cognitive impairment and dementia relative to non-Hispanic whites (Garcia, Saenz, Downer, & Wong, 2018; Gurland et al., 1999; Langa, Kabeto, & Weir, 2010). Furthermore, recent research shows Hispanics, particularly the foreign-born spend a larger proportion of their late-life years with cognitive impairment compared to non-Hispanic whites (Garcia, Downer, et al., 2017). While Hispanics have a higher prevalence of cognitive impairment, and spend fewer years cognitively intact in late-life; evidence on the risk of cognitive impairment has been mixed. For instance, differences in the incidence of cognitive impairment and/or dementia are less clear with some (Tang et al., 2001), but not all (Mayeda, Glymour, Quesenberry, & Whitmer, 2016; Mayeda et al., 2014) studies reporting a higher incidence of cognitive impairment and/or dementia among Hispanics than non-Hispanic whites.

Cognitive impairment (from mild cognitive impairment-MCI to severe dementia) is a major contributor to disability and premature death for older adults. Approximately a third of dementia risk may be due to potentially preventable or modifiable lifestyle (e.g. high fat diet, physical inactivity), social conditions (low education), and chronic diseases (midlife obesity, diabetes), (Norton, Matthews, Barnes, Yaffe, & Brayne, 2014). Older Mexican-Americans are characterized by a high prevalence of diabetes, obesity, low physical activity, and low educational attainment. These characteristics have been identified as risk factors for dementia and cognitive decline (Beard, Markides, Al Ghatrif, Kuo, & Raji, 2010; Centers for Disease Control and Prevention, 2014; Downer et al., 2016). This high prevalence is due to a multitude of factors, including, fewer opportunities for formal education, less access to health care services, poor access to nutritious foods, unsafe living conditions that prohibit physical activity, and physically demanding work conditions. The risk for cognitive impairment for older Mexican-Americans may also be influenced by the degree and type of acculturation (i.e. positive or negative), which varies by age of immigration, number of years lived in the United States, and gender. To develop interventions that can reduce onset of cognitive impairment and dementia, it is important to understand the differences in risk factors for cognitive impairment by age of migration, level of acculturation, and gender.

Research has only recently begun to examine how cognitive functioning for older Hispanics may differ by nativity status (Downer, Garcia, Saenz, Markides, & Wong, 2017; Garcia, Downer, et al., 2017; Garcia, Saenz, et al., 2017; Garcia et al., 2018; Hill, Angel, & Balistreri, 2012; Hill,

Angel, Balistreri, & Herrera, 2012; Weden et al., 2017). An analysis of the Health and Retirement Study revealed that foreign-born Mexican-Americans had a 36% lower risk for incident cognitive impairment than non-Hispanic whites independent of age, gender, and socioeconomic characteristics. However, U.S.-born Mexican-Americans had a 27% higher risk for incident cognitive impairment compared to non-Hispanic whites (Weden et al., 2017). In addition, research using the Hispanic Established Populations for the Epidemiologic Study of the Elderly (H-EPESE) found that foreign-born Mexican-American men, but not women, who migrate to the United States in middle age (20–49 years old) exhibit higher cognitive function and less cognitive decline as older adults compared to U.S.-born Mexican-American men (Hill, Angel, & Balistreri, 2012; Hill, Angel, Balistreri, et al., 2012).

Hispanics, particularly the foreign-born, have consistently been shown to have longer life expectancy than non-Hispanic whites and non-Hispanic blacks (Garcia, Downer, et al., 2017; Markides & Eschbach, 2011). These findings have been attributed to Hispanic immigrants being positively selected from the general population for health characteristics. Health selection is considered to be strongest for foreign-born Hispanic men who migrate as young or middle-aged adults to obtain employment. These individuals must be cognitively resilient and physically healthy enough to work once they arrive in the United States. These traits may ultimately affect health and mortality (Angel, Angel, Diaz Venegas, & Bonazzo, 2010; Garcia & Reyes, 2017). The positive health selection that contributes to longer life expectancy may also contribute to a reduced risk for cognitive impairment, preserved cognitive functioning, and slower cognitive decline among foreign-born Hispanics compared to their U.S.-born counterparts. The strong positive health selection for foreign-born Hispanic men may also contribute to the gender disparity in the relationship between nativity, age of migration, and cognitive decline that has been reported by Hill and colleagues (Hill, Angel, & Balistreri, 2012; Hill, Angel, Balistreri, et al., 2012). This disparity also makes it important to examine men and women separately to identify gender- and sex-specific factors that may influence the risk for cognitive impairment among older Hispanics.

Research on cognitive function among older Mexican-Americans has found a robust relationship between age of migration, prevalence of cognitive impairment, cognitive life expectancies, and cognitive decline (Downer et al., 2017; Garcia, Saenz, et al., 2017; Hill, Angel, & Balistreri, 2012; Hill, Angel, Balistreri, et al., 2012). However, less scholarship has focused on how age of migration is related to the risk of incident cognitive impairment. Studies that used prevalence of cognitive impairment as outcomes may not help clarify the direction of any association between migration experiences and onset of cognitive impairment. Consequently, this study contributes to the literature on Hispanic health by examining whether the immigrant

advantage that has been observed in mortality among foreign-born Mexican-Americans extends to the risk of *new-onset* cognitive impairment by age of migration and gender. We hypothesize positive health selection will lead to a lower risk of incident cognitive impairment among foreign-born Mexican-Americans who migrate to the United States in midlife (age 20–49), in particular, for foreign-born males, relative to U.S.-born Mexican-Americans. We also hypothesize that the incidence of cognitive impairment will be lower in males than females.

Methods

Data

Using data from the H-EPESE, we document nativity and age of migration differentials in the risk of incident cognitive impairment among older Mexican-origin adults. The H-EPESE is a large, multistage probability sample of older (age 65+) Mexican-Americans residing in Arizona, California, Colorado, New Mexico, and Texas (Markides, Rudkin, Angel, & Espino, 1997). The survey provides detailed information on demographic characteristics, health, and immigration history for a sample of 3,050 individuals who ranged in age from 65 years to 105 years at baseline (1993–94). This panel was recontacted in 1995–96, 1998–99, 2000–01, 2004–05, 2007, 2010–11, and 2012–2013 for a total of up to 8 observations per person. Due to attrition in the original cohort, a new cohort of 902 individuals aged 75 and older was added in 2004–05 to increase sample size and statistical power. The new panel was recontacted in 2007, 2010–11, and 2012–13.

The final analytic sample for the present analysis includes 3,671 observations for 1,131 men and 5,325 observations for 1,577 women. The average respondent contributes 3.5 observations of data. Respondents must be present for at least two waves to be included in the analysis. Since this analysis focused on the incidence of cognitive impairment, participants classified as cognitively impaired (see Measures) at baseline were excluded from the final analytic sample.

Measures

Cognitive function is assessed at each wave using the Mini Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975). The scores range from 0 to 30, with higher scores indicating better cognitive function. Following previous research on older Mexican-Americans in the H-EPESE, we dichotomized the MMSE score as <21 for cognitive impairment and ≥21 for normal cognition (Garcia, Saenz, et al., 2017; Raji, Al Snih, Ray, Patel, & Markides, 2004; Samper-Ternent, Al Snih, Raji, Markides, & Ottenbacher, 2008). This cut point has been shown to accurately identify older adults with cognitive impairment in populations with low educational attainment (Uhlmann & Larson, 1991). Respondents could complete the MMSE in English or Spanish.

Our main independent variable of interest is a combination of nativity and age of migration. Nativity is distinguished by country of birth (United States vs Mexico). Following previous research, we create three life course stage at migration categories among the foreign-born (Angel et al., 2010; Hill, Angel, & Balistreri, 2012): early-life immigrants (migrated age 0–19), midlife immigrants (migrated age 20–49), and late-life immigrants (migrated after age 50).

Sociodemographic variables controlled for in the analysis include age, years of education, marital status, living arrangements, financial strain, and language of interview. Marital status is measured each wave using an indicator for currently married. Living arrangements are measured each wave using an indicator for those living alone compared to living with family members and/or spouse. Financial strain measures whether respondents report having difficulty paying bills or not having enough money at each wave. Language assesses whether the interview was conducted in English or Spanish.

At each wave, we control for several aspects of health associated with the onset of cognitive impairment including chronic conditions, impairment in activities of daily living (ADL), and instrumental activities of daily living (IADL). Respondents are asked if they have ever been diagnosed with heart disease, stroke, hypertension, cancer, diabetes, and arthritis. Ability to complete ADLs is assessed by asking respondents if they can perform the following tasks: walk across a small room, bathe, groom, dress, eat, transfer in/out of bed, and use a toilet. IADLs are assessed with activities such as: using a telephone, use of transportation, going shopping, preparing meals, doing light housework, taking medications, handling finances, doing heavy housework, walking up/down stairs, and walking half a mile. We control for being unable to perform or having difficulty in one or more of the tasks to be considered having an ADL or IADL limitation.

We also include respondents' Center for Epidemiologic Studies–Depression (CES-D; Radloff, 1977) score at each wave given the strong association between depression and cognitive decline in the H-EPESE (Nguyen, Black, Ray, Espino, & Markides, 2002). Smoking and drinking were also included as covariates since these health behaviors have been correlated with cognitive functioning among Mexican-Americans (Collins, Sachs-Ericsson, Preacher, Sheffield, & Markides, 2009; Haan, Zeki Al-Hazzouri, & Aiello, 2011). In addition, we include an indicator of sample cohort to specify the new cohort of respondents that was added to the survey in 2004–05. This variable was included to control for known differences in sociodemographic, health, and functional characteristics between participants who were added to the sample in 2004–05 and participants aged 75 and older in the 1993–94 cohort (Beard, AlGhatrif, Samper-Ternent, Gerst, & Markides, 2009; Beard et al., 2010). We also included a variable that indicated if the respondent required assistance from a proxy to complete an interview.

Analysis

In the analyses below, we describe the characteristics of our analytic sample at first observation and use chi-square and z-tests to assess nativity and age of migration differentials by gender. We use maximum-likelihood discrete time hazard models to estimate risk ratios of cognitive impairment (Allison, 2010). Individuals remain in the risk set until they become cognitively impaired or they are lost to follow up. After becoming cognitively impaired a small number of respondents ($N = 374$) have improvement in cognition, sensitivity tests find that excluding these respondents does not substantively change results. All individuals with cognitive impairment at the first observation are excluded from the analysis as it is not possible to determine the timing of the onset of cognitive impairment. Discrete time hazards are fit using logistic regression to estimate the risk of cognitive impairment as a function of age of migration, socioeconomic and demographic characteristics, health status, and health behaviors. We include all covariates as time-varying measures except years of education, age of migration, ever drinking, and ever smoking because these variables do not change overtime. The pseudo R-squared is also reported for each model to assess model fit across models (Menard, 2000).

All models were stratified by gender to account for longer life expectancy contributing to Mexican-American women being more likely than men to experience cognitive impairment in late life (Garcia, Saenz, et al., 2017). Furthermore, prior research has supported the notion of stronger health selectivity among male immigrants who are more likely to migrate for occupational opportunities (Garcia & Reyes, 2017). These differences in health selection may contribute to gender differences in the risk for cognitive impairment.

Model 1 examines nativity and age of migration differentials in cognitive impairment controlling for age. Models 2 adds socioeconomic status indicators: education, financial strain, marital status, living arrangements, and language of interview. Model 3 adds the following time-varying covariates: nine self-reported health conditions that may be partially responsible for nativity and age of migration differences in cognitive impairment as well as negative health behaviors (smoking and drinking). Model 3 also includes a variable that controls for if a participant required assistance from a proxy to complete an observation interview. This was done to control for H-EPESE participants who need assistance from a proxy to complete the interview often being in poorer health than participants who do not require a proxy.

Results

Descriptive Statistics

Table 1 reports descriptive characteristics for the 2,708 study participants by nativity, age of migration, and gender. Among women, foreign-born respondents who migrated in early-life are older, more likely to report having a heart attack, stroke, and hypertension compared with other groups. Conversely, foreign-born women who arrived in late-life (after age 50) report more ADL/IADL disability, higher CES-D scores, and lower levels of ever drinking or smoking. Among men, midlife immigrants are more likely to be married, and less likely to report having a heart attack, ADL disability, and have lower CES-D score than other male subgroups. All immigrant subgroups report lower levels of education, higher financial strain, and were less likely to have taken the interview in English than U.S.-born Mexican-Americans, particularly those arriving in late life. Women are half as likely as men to be married or have ever reported drinking or smoking.

Survival Models of Cognitive Impairment

Table 2 presents the results of cognitive impairment hazard ratios for Mexican-American women. Model 1 shows late-life immigrant women have an 80% higher risk of developing cognitive impairment compared to U.S.-born women, whereas there is no significant difference in cognitive impairment risk between early-life and midlife immigrant women and their U.S.-born counterparts. In Model 2, higher education and being married are associated with a decreased risk in developing cognitive impairment, whereas experiencing financial strain is associated with an increased risk of cognitive impairment among older Mexican-American women. The inclusion of socioeconomic and demographic characteristics reduces the relative risk of cognitive impairment by about half among late-life immigrant women relative to U.S.-born women. In Model 3, late-life immigrants have a 46% higher risk of developing cognitive impairment compared to U.S.-born women. Having reported a stroke, higher CES-D score, and proxy interview are associated with an increased risk for developing cognitive impairment. Respondents in the new cohort have a lower risk of developing cognitive impairment.

Table 3 presents the hazard ratios for cognitive impairment risk among Mexican-American men. Model 1 shows early- and late-life immigrant men have a 39% and 45% higher risk of developing cognitive impairment, respectively, compared to U.S.-born men. There is no significant difference in cognitive impairment risk between midlife immigrant men and their U.S.-born counterparts. Years of education attenuates the risk of cognitive impairment among all immigrant men (Model 2). In Model 2, midlife immigrant men have a 31% low risk of developing cognitive impairment compared to U.S.-born men, whereas early-life and midlife immigrant men have no significant increased risk of developing cognitive impairment relative to U.S.-born men once socioeconomic characteristics are accounted for in the model. Financial strain is associated with increased risk of cognitive impairment among older Mexican-American men. Adjusting for socioeconomic

Table 1. Baseline Characteristics by Gender and Age of Migration Among Mexican-Americans 65 Years and Older

| | Females | | | | | | | | Males | | | | | | | |
| | USB | | 0–19 | | 20–49 | | 50+ | | USB | | 0–19 | | 20–49 | | 50+ | |
	Mean or %	SD	Mean or %	SD	Mean or %	SD	Mean or %	SD	Mean or %	SD	Mean or %	SD	Mean or %	SD	Mean or %	SD
Age[ab]	73.9	6.4	77.2	7.6	73.4	6.8	75.4	7.3	73.7	6.3	77.5	8.1	73.7	6.3	76.1	7.7
Years of education[ab]	6.0	3.9	4.8	3.7	4.7	3.6	3.5	3.3	6.7	4.3	4.3	3.6	4.1	3.3	3.3	2.8
Financial strain[ab]	0.25		0.29		0.29		0.32		0.21		0.27		0.29		0.34	
Married[ab]	0.43		0.32		0.47		0.34		0.75		0.73		0.77		0.75	
Live alone	0.28		0.27		0.28		0.23		0.15		0.14		0.12		0.11	
Chronic conditions																
Heart attack[a]	0.1		0.14		0.1		0.09		0.14		0.12		0.08		0.12	
Stroke	0.05		0.07		0.03		0.06		0.08		0.08		0.08		0.08	
Hypertension	0.52		0.56		0.54		0.5		0.41		0.35		0.39		0.38	
Cancer[b]	0.08		0.06		0.05		0.06		0.06		0.07		0.06		0.05	
Diabetes[ab]	0.31		0.3		0.28		0.22		0.29		0.27		0.3		0.33	
Arthritis	0.5		0.52		0.55		0.53		0.3		0.3		0.33		0.33	
Ever drink[b]	0.31		0.26		0.28		0.24		0.77		0.73		0.78		0.79	
Ever smoke[a]	0.28		0.26		0.28		0.25		0.64		0.57		0.64		0.64	
Any ADL[ab]	0.16		0.18		0.13		0.2		0.12		0.14		0.09		0.15	
Any IADL[ab]	0.54		0.64		0.61		0.71		0.38		0.48		0.41		0.53	
Total CES-D score[ab]	9.8	9.2	11.4	9.7	10.5	9.6	12.4	11.4	7.5	8.1	7.5	7.8	6.7	8.0	9.6	8.6
Survey in English[ab]	0.33		0.24		0.05		0.05		0.36		0.16		0.07		0.04	
Ever cognitively impaired[ab]	0.42		0.46		0.46		0.53		0.36		0.49		0.42		0.51	
Proxy[ab]	0.06		0.08		0.05		0.07		0.09		0.09		0.08		0.14	
Person observations	3,293	483	483		1,158		391		2,147		359		927		238	
N	961	152	152		336		128		661		131		257		82	

Note. Age of migration subgroups: early-life (0–19), midlife (20–49), late-life (50+). ADL = activities of daily living; IADL = instrumental ADL; CES-D = Center for Epidemiologic Studies–Depression; *SD* = standard deviation; USB = U.S.-born.

[a]Differences by age of migration are statistically significant at the *p* <.05 level for males. [b]Differences by age of migration are statistically significant at the *p* <.05 level for females.

Table 2. Hazards of Incidence of Cognitive Impairment by Nativity and Age of Migration for Mexican-American Women 65 Years and Older (*N* = 5,325)

	Model 1		Model 2		Model 3	
	RRR	*SE*	RRR	*SE*	RRR	*SE*
Age	1.08***	(0.01)	1.08***	(0.01)	1.07***	(0.01)
Age of migration (Ref = USB)						
0–19	1.03	(0.13)	0.89	(0.12)	0.80	(0.11)
20–49	1.08	(0.10)	0.95	(0.09)	0.94	(0.10)
50+	1.80***	(0.23)	1.42**	(0.18)	1.46**	(0.20)
Years of education			0.89***	(0.01)	0.89***	(0.01)
Financial strain			1.23*	(0.10)	1.12	(0.10)
Married			0.73**	(0.07)	0.79*	(0.08)
Live alone			0.90	(0.08)	0.99	(0.09)
Survey in English			1.09	(0.11)	1.12	(0.12)
Chronic conditions						
Heart					0.95	(0.15)
Stroke					1.36	(0.23)
Hypertension					0.90	(0.07)
Cancer					0.93	(0.14)
Diabetes					1.07	(0.09)
Arthritis					0.93	(0.08)
Ever drink					0.91	(0.08)
Ever smoke					0.91	(0.08)
Any ADL					1.37**	(0.14)
Any IADL					1.09	(0.10)
Total CES-D score					1.01**	(0.00)
Proxy					13.17***	(3.99)
Cohort					0.31***	(0.04)
Pseudo *R*-squared	.049		.080		.125	

Note. ADL = activities of daily living; IADL = instrumental ADL; CES-D = Center for Epidemiologic Studies–Depression; RRR = relative risk ratio; *SE* = standard error; USB = U.S.-born.
*$p < .05$; **$p < .01$; ***$p < .001$.

and demographic characteristics reduces the risk among early- and late-life immigrant men to nonsignificance. After controlling for health status, health behaviors, and proxy interview, midlife immigrant men continue to have a 29% decreased risk of developing cognitive impairment compared to U.S.-born men. Having an IADL disability and proxy interview are associated with an increased risk for cognitive impairment onset. Conversely, being in the new sample cohort is associated with a decreased risk of developing cognitive impairment among Mexican-American men.

Figure 1 provides a visual representation for the differences in risk for cognitive impairment according to nativity and age of migration for women and men. The figure highlights the substantial increase in risk of cognitive impairment over time regardless of nativity, age of migration, and gender. The figure also illustrates that Mexican-American women who migrated at 50+ years of age maintain the highest risk for cognitive impairment among women, whereas Mexican-American men who migrated between 20 and 49 years of age have the lowest risk for cognitive impairment among men.

Discussion

The substantial growth of Mexican-origin individuals in the United States underscores the need to identify risk factors for cognitive impairment in this population. Such identification is a key step in developing and implementing cohort-specific and culturally relevant public health programs to stem the onset of cognitive impairment. The findings of the present analysis showed the risk for incident cognitive impairment among foreign-born Mexican-Americans varies by age of migration and gender of immigrants. Consistent with our hypothesis, foreign-born Mexican-American men who immigrated in midlife had significantly lower risk for developing cognitive impairment relative to U.S.-born Mexican-American men. Conversely, foreign-born Mexican-American women who migrated in late life had significantly higher risk for developing cognitive impairment compared to U.S.-born Mexican-American women, suggesting a need for more targeted interventions, particularly for older late-migrating women.

The observed findings may reflect several factors. Foreign-born Mexican-Americans who migrate to the

Table 3. Hazards of Incidence of Cognitive Impairment by Nativity and Age of Migration for Mexican-American Men 65 Years and Older (*N* = 3,671)

	Model 1		Model 2		Model 3	
	RRR	SE	RRR	SE	RRR	SE
Age	1.08***	(0.01)	1.09***	(0.01)	1.08***	(0.01)
Age of migration (Ref = USB)						
0–19	1.39*	(0.20)	1.06	(0.15)	1.00	(0.15)
20–49	0.91	(0.10)	0.69**	(0.08)	0.71**	(0.08)
50+	1.45*	(0.25)	1.03	(0.18)	1.03	(0.19)
Years of education			0.90***	(0.01)	0.90***	(0.01)
Financial strain			1.23*	(0.13)	1.10	(0.12)
Married			1.04	(0.14)	1.07	(0.15)
Live alone			0.82	(0.14)	0.88	(0.15)
Survey in English			0.87	(0.11)	0.85	(0.12)
Chronic conditions						
Heart					0.85	(0.14)
Stroke					1.33	(0.25)
Hypertension					0.85	(0.08)
Cancer					0.91	(0.17)
Diabetes					0.87	(0.09)
Arthritis					1.19	(0.11)
Ever drink					1.05	(0.14)
Ever smoke					0.91	(0.10)
Any ADL					1.42**	(0.19)
Any IADL					1.37**	(0.15)
Total CES-D score					1.00	(0.01)
Proxy					6.73***	(2.01)
Cohort					0.41***	(0.07)
Pseudo *R*-squared	.049		.076		.114	

Note. ADL = activities of daily living; IADL = instrumental ADL; CES-D = Center for Epidemiologic Studies–Depression; *SE* = standard error; USB = U.S.-born.
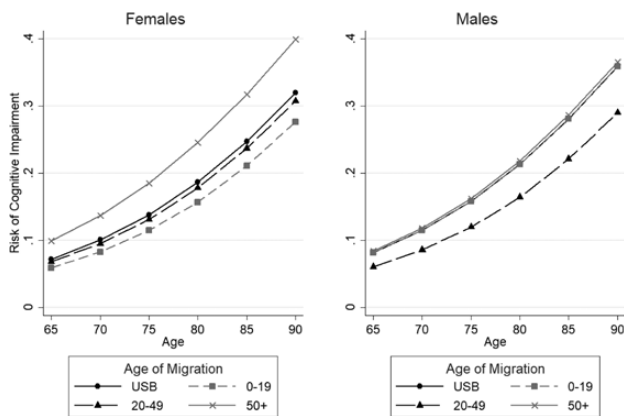**p* < .05; ***p* < .01; ****p* < .001.

Figure 1. Risk of cognitive impairment by age of migration and gender. Predicted risk of cognitive impairment by age of migration for males and females. Calculations are based on coefficients reported for model 3 in Table 2 for females and for model 3 in Table 3 for males. All other variables are set to their mean. USB = U.S.-born.

Unites States might be positively selected from the general population based on positive health characteristics (e.g. physical and mental resiliency) that allow better coping with the stress of the migration process and potentially contribute to lower mortality in the United States (Fenelon, Chinn, & Anderson, 2017). These characteristics may also explain the lower risk of new onset of cognitive impairment among midlife immigrants compared to the late-life immigrants. This explanation is supported by research that showed a significant association between being frail (having poor muscle strength and physical activity, weight loss, exhaustion, and slow walking speed) and subsequent cognitive impairment (Samper-Ternent et al., 2008).

However, the strength of this health selection can vary by age of migration since the motivations to migrate often differ by age and gender (Angel et al., 2010; Treas, 2015). Early-life immigrants have little or no health selection because young and adolescent individuals are often migrating with a parent and any health selection is based on the characteristics of their parent(s) as they do not experience the demands of migration themselves (Angel & Angel, 1999; Gubernskaya, 2015). Furthermore, early-life immigrants have a longer time to incorporate to United States main stream institutions and accumulate socioeconomic resources which positively affect cognitive health in later

life (Garcia, Saenz, et al., 2017; Hill, Angel, Balistreri, et al., 2012). Likewise, health selection may be weaker among late-life immigrants because the decision to migrate is frequently made to join family already living in the United States rather than occupational opportunities (Angel et al., 2010; Gubernskaya, 2015). In addition, late-life immigrants may experience disruptions to their long-established social networks, which can potentially lead to social disengagement, loneliness, and decreased social activities; all of which have been associated with poor cognitive and physical functioning (Barnes-Mauthe, Arita, Allen, Gray, & Leung, 2013; Fratiglioni, Wang, Ericsson, Maytan, & Winblad, 2000; Holtzman et al., 2004; Tsutsumimoto et al., 2017; Kuo, Raji, Peek, & Goodwin, 2004). For instance, recent research shows higher scores on social frailty (going out less frequently, rarely visiting friends, feeling unhelpful to friends or family, living alone, and not talking with someone every day) are associated with an increased risk of cognitive deficits (Tsutsumimoto et al., 2017). Conversely, health selection is strongest for immigrants who are young or middle-aged adults since the decision to migrate is often for employment or occupation (Markides, Eschbach, Ray, & Peek, 2007). Labor migrants are by definition healthy enough to migrate and work when they arrive (Angel et al., 2010).

The present analysis provides evidence that the relationship between age of migration and risk for cognitive impairment may differ by gender. These findings are supported by previous research that has found a strong association between age of migration, gender and cognitive functioning (Hill, Angel, & Balistreri, 2012; Hill, Angel, Balistreri, et al., 2012), prevalent cognitive impairment (Downer et al., 2017), and life expectancies with cognitive impairment (Garcia, Saenz, et al., 2017). Our study advances this literature by documenting differences by age of migration and gender for the incidence of cognitive impairment. Possible gender differences in the risk for cognitive impairment among foreign-born Mexican-Americans may be partly attributed to gender differences in the factors that motivate the decision to migrate to the United States. Traditionally, men migrate to the United States for occupation reasons whereas women tend to migrate to reunite with family (Angel, Angel, & Hill, 2015). These differences may contribute to a stronger health selection for foreign-born men compared to women (Treas, 2015).

The increased risk for cognitive impairment among late-life immigrant women and decreased risk among midlife immigrant men remained statistically significant after controlling for multiple health conditions, functional limitations, and health behaviors. A noteworthy finding is that women and men in the replenishing cohort had 0.14 and 0.22 lower risk for cognitive impairment relative to the original cohort. Comparisons between the two H-EPESE cohorts indicate that the replenishing cohort has, on average, one more year of education, but has a substantially higher prevalence of diabetes, obesity, hypertension, and

geriatric syndromes (Beard et al., 2009; Beard et al., 2010). Our findings may not indicate a lower risk of cognitive impairment in the replenishing cohort, but rather be an artifact of a shorter follow-up period for the replenishing cohort. Further research is needed to explore potential cohort differences in the risk cognitive impairment in the H-EPESE.

A limitation of this analysis is that the MMSE was used to classify participants as cognitively impaired. Prior research has reported that specific questions in the MMSE are culturally biased for Hispanics (Ramirez, Teresi, Holmes, Gurland, & Lantigua, 2006), which can reduce the accuracy of the MMSE for identifying cognitive impairment in Hispanic populations (Jones, 2006). We used a lower cutoff on the MMSE to account for the low educational attainment of H-EPESE participants; however, this approach does not account for potential biases in cognitive impairment classification due to lower educational quality (Black et al., 1999; Gamaldo et al., 2017). Our findings need to be replicated by analyses that use a comprehensive neuropsychological battery to determine cognitive impairment and to examine if particular cognitive domains are more susceptible to impairment. A second limitation is that the H-EPESE only includes Mexican-American participants. This prevented us from being able to compare our findings on the risk for cognitive impairment among the U.S.-born and foreign-born Mexican-Americans to other racial and ethnic groups, as well as other Hispanic groups (such as Cuban, Central and South American, and Caribbean origins). Recent research has found a foreign-born Mexican-American advantage in the risk of cognitive impairment compared to non-Hispanic whites and blacks in a nationally representative sample of older adults in the United States (Weden et al., 2017). However, this analysis did not consider potential differences in the risk for cognitive impairment among foreign-born by gender or age of migration. Additional research is needed to compare the risk of cognitive impairment of foreign-born Mexican-Americans by gender to other racial/ethnic, and immigrant groups to further assess whether the immigrant advantage that has been observed in mortality extends to cognition.

Future research should also examine the potential role that other factors including social support and sociocultural factors have on the risk for cognitive impairment for Mexican-Americans. Prior research indicates that H-EPESE participants who live in counties with larger Hispanic populations have fewer years of education and lower household income, but are less likely to report medical conditions and have lower mortality when compared to participants who live in counties with fewer Hispanics (Eschbach, Ostir, Patel, Markides, & Goodwin, 2004). The authors attributed the lower mortality to greater social support in communities with large Hispanic populations (Eschbach et al., 2004). The impact that neighborhood characteristics may have on the risk for cognitive impairment is unclear. The lower prevalence of health conditions would be beneficial

for cognitive functioning however the lower risk for mortality places these participants at greater risk for cognitive impairment.

In summary, this analysis provides evidence that the risk for cognitive impairment among older Mexican-Americans varies by gender and age of migration to the United States. These findings have implications for public policy and for the design and implementation of public health interventions meant to reduce the risk for cognitive impairment among older Mexican-Americans. Public officials involved in policy, in particular, those in regions with large populations of older Mexican-Americans, need to be made aware of the importance that gender and age of migration have on the risk for cognitive impairment. Greater awareness will lead to a better understanding among policy makers of the kinds of resources that may need to be made available to meet the needs of a population that is likely to experience a high burden of cognitive impairment. Public health interventions also need to become more culturally sensitive for older Mexican Americans. This includes disseminating information that addresses the negative stigma and misconceptions about dementia and cognitive impairment (Connell, Scott Roberts, & McLaughlin, 2007; Sayegh & Knight, 2013), and recognizing cultural factors that may be barriers to adopting positive health behaviors that can prevent chronic diseases (Staten, Scheu, Bronson, Peña, & Elenes, 2005; Van Duyn et al., 2007). Few dementia interventions designed specifically for older Mexican-Americans exist (Gonyea, López, & Velásquez, 2016) and continued research in this area is needed in order to address the future prevalence of cognitive impairment and dementia in this population.

Conflict of Interest

None reported.

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