Does the “Healthy Immigrant Effect” Extend to Cognitive Aging?

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Abstract

We test whether the "healthy immigrant effect" extends to indicators of cognitive aging. 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 growth curve models to assess variations in cognitive functioning trajectories by nativity and age at migration. Our results suggest that the cognitive functioning trajectories of early (before age 20) and late life migrants (50 and older) are similar to those of the US-born. We also find that those who immigrated between the ages of 20 and 49 tend to exhibit a slower rate of cognitive decline than the US-born; moreover, this pattern is especially pronounced for men. Although our results suggest that the health advantage of Mexican immigrants extends to cognitive aging, additional research is needed to explore selection processes that are specific to age at migration and gender.

Introduction

Studies show that immigrants to the United States are healthier than their native-born counterparts across a range of outcomes, including, for example, health behaviors (Kimbro, 2009; Lopez-Gonzalez, Aravena, & Hummer, 2005), body mass (Antecol & Bedard, 2006; Hao & Kim, 2008), allostatic load (Kaestner, Pearson, Keene, & Geronimus, 2009; Peek, Cutchin, Salinas, Sheffield, Eschbach, Stowe, & Goodwin, 2010), chronic conditions (Jasso, Massey, Rosenzweig, & Smith, 2004), and mortality risk (Abraido-Lanza, Dohrenwend, Ng-Mak, & Turner, 1999; Angel, Angel, Venegas, & Bonazzo, in press). Yet, the health advantages of immigrants tend to wane with length of residence in the United States, presumably as a result of negative acculturation processes (Antecol & Bedard, 2006; Lopez-Gonzalez, Aravena, & Hummer, 2005; Vega & Amaro, 1994). The rate at which the health of immigrants converges with the native-born population also varies by gender, with immigrant men maintaining their health advantages for longer periods of time (Antecol & Bedard, 2006; Hao & Kim, 2008; Lara, Gamboa, Kahramanian, Morales, & Bautista, 2005).

Although previous research has made significant contributions to our understanding of immigration and health, it is unclear whether the "healthy immigrant effect" extends to indicators of cognitive aging. In this paper, we test whether the cognitive functioning trajectories of older Mexican Americans vary according to nativity, age at migration, and gender. In accordance with previous work, we hypothesize that older Mexican immigrants will exhibit slower rates of cognitive decline than their native-born counterparts. We also expect that this pattern will be more pronounced with increasing age at migration, especially for men.

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). The H-EPESE survey is based on a probability sample of 3,050 Mexican-origin individuals 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 2007-2008. The response rate at baseline was 86%. The surveys included detailed information on health and functioning, immigration history, and demographic characteristics. Note that we have omitted proxy respondents (n = 316) from the analytic sample due missing or invalid responses on the dependent variable. Table 1 provides baseline descriptive statistics for selected study variables.

<TABLE 1 ABOUT HERE>

Measurement of Nativity and Age at Migration

Following previous research (Angel, Angel, & Hill, 2008, 2009; Angel et al., in press), we created four nativity status and age at migration groups of Mexican Americans: Group 1 represents those who were born in the United States. Group 2 represents those who born in Mexico and migrated to the United States before the age of 19. Group 3 represents those who were born in Mexico and migrated to the United States between the ages of 20 and 49 years. Finally, Group 4 represents those who were born in Mexico and migrated to the United States between the ages of 50 and 90 years. In our main analysis, United States-born Mexican Americans (Group 1) serve as the reference category against which the Mexico-born groups (Groups 2-4) are compared.

Measurement of Cognitive Functioning

We use 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. The MMSE represents a brief, standardized method by which to grade cognitive mental status (see Folstein, Folstein, & McHugh, 1975). It measures responses to a standard battery of memory and reasoning items. It 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 of the MMSE were drawn from the Diagnostic Interview Scale (see Bird, Canino, Rubio-Stipec, & Shrout, 1987). The Spanish version of the MMSE conforms to standard criteria, including formal translation, backtranslation, and consensus by committee for final content. The Spanish version of the MMSE has been used in several studies of older Mexican Americans (Black et al., 1999; Haan & Weldon, 1996; Hill et al. 2006; Nguyen, Black, Ray, Espino, & Markides, 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 used MMSE scores below 18 and between 18 and 23 to reflect severe cognitive impairment and mild cognitive impairment, respectively. In the present study, we used the continuous specification of MMSE scores to directly assess cognitive functioning trajectories.

Measurement of Mental Health

Studies show that depression is a risk factor for cognitive decline (Black et al., 1999; Nguyen et al., 2002; Wu et al., 2003). We use the Center for Epidemiologic Studies Depression scale (CES-D) to measure depressive symptoms. The CES-D measures responses to 20 items (see 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.

Measurement of Health Behaviors

Research shows that smoking and drinking are significant correlates of cognitive functioning (Haan & Wallace, 2004; Herbert et al., 1993; Kalmijn, van Boxtel, Verschuren, Jolles, & Launer, 2002). We measure smoking behavior with a single item. Respondents were asked, ‘‘Do you smoke cigarettes now?’’ We also measure 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.

Measurement of Physical Health and Functioning

A number of chronic conditions have been identified as significant risk factors for cognitive decline, including diabetes (Nguyen et al., 2002; Wu et al., 2003), hypertension (Swan, Carmelli, & Larue, 1998; Birkenhager, Forette, Seux, Wang, & Staessen, 2001), stroke (Black et al., 1999; Nguyen et al., 2002), and heart attack (Tilvis et al., 2004). Our measures of these 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.

Research shows that functional limitations are associated with worse cognitive functioning (Zarit, Johansson, & Malmberg, 1995). With this concern in mind, subsequent analyses control for activities of daily living (ADLs) at baseline (see Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963). We measure 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.

Like functional limitations, vision and hearing impairments are also significant risk factors for poor cognitive functioning (Lindenberger & Baltes, 1994; Nguyen et al., 2002). We measure visual acuity with a modified Snellen test (Salive et al., 1994). This method categorizes distance vision into three levels of acuity: adequate vision (≤ 20/40), visual impairment (> 20/40 to ≤ 20/200), and functional blindness (> 20/200). Once we deleted proxy respondents from the sample, very few respondents could be classified as functionally blind (n = 94). As a result, we coded respondents as (1) for visual impairment or functional blindness and as (0) for adequate vision. We measure hearing problems with the screening version of the Hearing Handicap Inventory for the Elderly (HHIE-S; Lichtenstein, Bess, & Logan, 1988). The 10-item HHIE-S measures self-perceived functional, social, and emotional difficulties associated with hearing loss. In addition to the HHIE-S, we considered whether the respondent wore a hearing aid, as well as interviewer ratings of hearing difficulties. Following the work of Davanipour and colleagues (2000), we coded respondents as (1) for hearing impaired if they ever wore a hearing aid, have difficulty hearing as perceived by the interviewer, or scored higher than 8 on the HHIE-S, and as (0) for adequate hearing.

Measurement of Background Factors

Several background factors have been identified as significant correlates of cognitive functioning (Angel et al., 2003; Bassuk, Glass, & Berkman, 1999; Black et al., 1999; Hill et al., 2006; Mulgrew et al., 1999; Nguyen et al., 2002). In accordance with this research, subsequent analyses include controls for age, gender, education, personal income, financial strain, English language proficiency, religious attendance, and social disengagement.

Age is a continuous variable, ranging from (65) to (107). *Gender* is coded as (1) for females and (0) for males. *Education* is coded as (1) for high school diploma or greater and as (0) otherwise. *Personal income* assesses income from all sources (e.g., wages, salaries, Social Security, retirement benefits, and help from relatives). Response categories for personal income range from (1) ≤ $4,999 to (8) ≥ $50,000. *Financial strain* is 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 measure financial strain as the mean response to these two items. Note that these items have been standardized to account for metric differences.

We measure *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.

Religious attendance is measured with a single item. Respondents were asked, "About how often do you go to mass or services?'' Response categories for this item range from (0) never or almost never to (4) more than once a week.

We measure several aspects of *social disengagement*, including marital status, monthly contact with family and friends, secular group memberships, and living arrangements. Marital status was coded as (1) for unmarried and as (0) otherwise. Monthly contact was coded as (1) for no monthly contact and as (0) otherwise. We coded secular group membership as (1) for no memberships and as (0) otherwise. Finally, we coded living arrangements as (1) for living alone and as (0) otherwise. Our final measure of social disengagement represents a summed index of these four items.

Statistical Procedures

We use linear growth curve modeling to describe and predict cognitive functioning trajectories over the fifteen 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).

Supplemental Attrition Analysis

When considering outcomes over time, it is customary to examine the issue of sample attrition. The primary concern is whether there is any systematic loss to follow-up. To formally assess this issue, we estimated a binary logistic regression model predicting the log odds of sample attrition (results not shown). The dependent variable in this case is dummy-coded such that respondents who completed questionnaires at baseline and at least one subsequent wave were given a value of zero, and those who were missing over the final five waves were given a value of one. The independent variables in this analysis include all of the predictors from our main analysis. Approximately 17% of the sample was lost to follow-up (i.e., failed to complete a follow-up interview). The results of our logistic regression analysis indicated that early life migration (OR = 1.49, $p < 0.05$), diabetes (OR = 1.57, $p < 0.001$), and trouble performing activities of daily living (OR = 1.91, $p < 0.001$) increased the odds of attrition, while middle life migration (OR = 0.70, $p < 0.05$), age (OR = 0.98, $p < 0.05$), female status (OR = 0.60, $p < 0.001$), drinking (OR = 0.61, $p < 0.05$), and better cognitive functioning (OR = 0.96, $p < 0.05$) reduced the odds of attrition. Because our main analysis controls for these factors and uses full maximum likelihood estimation, sample attrition is unlikely to bias our regression coefficients (Raudenbush & Bryk, 2002).

Results

Table 2 presents the results of our growth curve analysis. Model 1 estimates an unconditional growth model to assess the average growth rate and to test for significant variation in individual growth rates. The results for the mean growth rate indicate that, on average, cognitive functioning declined by approximately 1.68 points per wave or 8.40 points over the fifteen year study period. Although it is difficult to compare average growth rates from sample to sample and study to study, prior research shows that the rate of MMSE decline may range from 0.13 to 3.4 points per year (Doody, Massman, & Dunn, 2001; Hill et al., 2006; Mungas, Reed, Ellis, & Jagust, 2001; Royall, Palmer, Chiodo, & Polk, 2004; Wilson, Gilley, Bennett, Beckett, & Evans, 2001). It should be emphasized, however, that the random effect estimate for the individual growth parameters (i.e., growth rate variance) suggests that there is significant variability in individual rates of cognitive decline. In other words, many respondents declined either faster or slower than the average growth rate.

<TABLE 2 ABOUT HERE>

Model 2 estimates a conditional growth model to test whether nativity status and age at migration predict variation in individual growth rates with controls for baseline cognitive functioning, mental health, health behaviors, physical health and functioning, and background factors. Although the cognitive functioning trajectories of early (before age 20) and late life migrants (50 and older) are similar to those of the US-born, those who migrated between the ages of 20 and 49 tend to exhibit a slower rate of cognitive decline than the US-born. Figure 1 provides a graphical illustration of this pattern.

<FIGURE 1 ABOUT HERE>

Model 3 adds three interaction terms to Model 2 to formally test whether the effects of nativity status and age at migration vary for women and men. The results of this analysis suggest that the effects of early and late life migration are similar for women and men. We also observe a statistically significant interaction term for middle life migration. The nature of the interaction term is negative. This suggests that the protective effects of middle life migration are more pronounced for men (or attenuated for women). Figure 2 provides a graphical illustration of this pattern.

<FIGURE 2 ABOUT HERE>

Discussion

Although previous studies show that immigrants to the United States tend to be healthier than their native-born counterparts, it is unclear whether the "healthy immigrant effect" extends to indicators of cognitive aging. Building on previous research, we tested whether the cognitive functioning trajectories of older Mexican Americans varied according to nativity, age at migration, and gender. We hypothesized that that older Mexican immigrants would exhibit slower rates of cognitive decline than their native-born counterparts. We also expected that any immigrant health advantage would be more pronounced with increasing age at migration, especially for men.

Our results showed that the cognitive functioning trajectories of early (before age 20) and late life migrants (50 and older) were similar to those of the US-born. We also found that those who immigrated between the ages of 20 and 49 tended to exhibit a slower rate of cognitive decline than the US-born; moreover, this pattern was especially pronounced for men.

Because we are the first to test whether the "healthy immigrant effect" extends to indicators of cognitive aging, it is difficult to compare our study to previous research. Our results are generally consistent with previous work that documents a "healthy immigrant effect" (Abraido-Lanza, Dohrenwend, Ng-Mak, & Turner, 1999; Jasso, Massey, Rosenzweig, & Smith, 2004; Peek, Cutchin, Salinas, Sheffield, Eschbach, Stowe, & Goodwin, 2010). However, we are unable to complement recent work that attributes a mortality advantage to Mexican Americans who immigrated in late life (Angel, Angel, Venegas, & Bonazzo, in press).

Our analysis of cognitive aging is inconsistent with previous studies that report a declining health advantage with length of residence in the United States (Antecol & Bedard, 2006; Lopez-Gonzalez, Aravena, & Hummer, 2005; Vega & Amaro, 1994). Our results confirm a gendered convergence process, with immigrant men maintaining their health advantage for longer periods of time (Antecol & Bedard, 2006; Hao & Kim, 2008; Lara, Gamboa, Kahramanian, Morales, & Bautista, 2005).

Why do middle life migrants tend to exhibit a slower rate of cognitive decline than the US-born, while early and late life migrants do not? Why are the benefits of middle life migration more pronounced for men? One possible explanation points to the unique cognitive complexities of acculturation and adaptation to new social (developing new relationships), cultural (acquiring a second language), and economic (finding employment) systems. Middle life migration occurs during a period of the life course that is defined by independence, productivity, and status attainment, especially for men. Efforts to meet these expectations are likely to require an intense mobilization of cognitive faculties, which could favor healthy cognitive aging by maintaining dense neocortical synapses in the brain. This explanation is, however, purely speculative.

Although our results suggest that the health advantage of Mexican immigrants extends to cognitive aging, additional research is needed to explore selection processes that are specific to age at migration and gender. Work along these lines would promote a more thorough understanding of immigrant health.

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Table 1. Baseline Descriptive Statistics (H-EPESE, 1993-1994)

	Range	Mean	SD
Nativity/Age at Migration			
US-born	0 – 1	0.57	
Immigrant (1-19)	0 – 1	0.14	
Immigrant (20-49)	0 – 1	0.21	
Immigrant (50-90)	0 – 1	0.08	
Cognitive Functioning			
MMSE	13 – 30	25.55	3.67
Mental Health			
CES-D	0 – 54	14.70	7.44
Health Behaviors			
Current Smoker	0 – 1	0.13	
Current Drinker	0 – 1	0.17	
Physical Health and Functioning			
Diabetic	0 – 1	0.27	
Hypertensive	0 – 1	0.42	
History of Stroke	0 – 1	0.05	
History of Heart Attack	0 – 1	0.10	
Hearing Impairment	0 – 1	0.20	
Vision Impairment	0 – 1	0.10	
ADLs (≥ 1)	0 – 1	0.09	
Background Factors			
Age	65 – 96	25.55	3.67
Female	0 – 1	0.57	
Education (≥ HS diploma)	0 – 1	0.10	
Personal Income	1 – 8	1.88	0.91
Financial Strain	-1.51 – 1.51	-0.00	0.89

English Proficiency	1 – 4	2.34	1.13
Religious Attendance	0 – 4	2.14	1.29
Social Disengagement	0 – 4	1.70	0.97

Notes: H-EPESE = Hispanic Established Populations for the Epidemiologic Study of the Elderly. n = 2,286. MMSE = Mini-Mental State Exam. ADLs = activities of daily living. CES-D = Center for Epidemiologic-Depression Scale. HS = High School.

Table 2. Unconditional and Conditional Cognitive Functioning Trajectories (H-EPESE, 1993-2008)

Baseline Predictors	Model 1	Model 2		Model 3	
Nativity/Age at Migration					
Immigrant (1-19)		-0.08		-0.25	
		(0.15)		(0.26)	
Immigrant (20-49)		0.26	*	0.56	**
		(0.13)		(0.18)	
Immigrant (50-90)		-0.03		-0.13	
		(0.19)		(0.30)	
Immigrant (1-19)*Female				0.29	
				(0.31)	
Immigrant (20-49)*Female				-0.51	*
				(0.22)	
Immigrant (50-90)*Female				0.17	
				(0.36)	
Cognitive Functioning					
MMSE		0.16	***	0.16	***
		(0.01)		(0.01)	
Mental Health					
CES-D		-0.01		-0.01	
		(0.01)		(0.01)	
Health Behaviors					
Current Smoker		-0.20		-0.21	
		(0.15)		(0.15)	
Current Drinker		0.22		0.22	
		(0.12)		(0.12)	
Physical Health and Functioning					
Diabetic		-0.26	*	-0.26	*
		(0.11)		(0.11)	
Hypertensive		-0.01		-0.01	
		(0.09)		(0.09)	
History of Stroke		-0.27		-0.28	
		(0.26)		(0.26)	
History of Heart Attack		-0.06		-0.05	
		(0.16)		(0.16)	

Hearing			-0.18		-0.17	
			(0.13)		(0.13)	
Vision			-0.64	***	-0.65	***
			(0.18)		(0.18)	
ADLs (≥ 1)			-0.59	**	-0.58	**
			(0.22)		(0.22)	
Background Factors						
Age			-0.12	***	-0.12	***
			(0.01)		(0.01)	
Female			0.21		0.27	*
			(0.11)		(0.14)	
Education (≥ HS diploma)			0.07		0.08	
			(0.18)		(0.17)	
Personal Income			0.06		0.06	
			(0.06)		(0.06)	
Financial Strain			-0.02		-0.01	
			(0.06)		(0.06)	
English Proficiency			0.16	**	0.16	**
			(0.05)		(0.05)	
Religious Attendance			0.18	***	0.18	***
			(0.04)		(0.04)	
Social Disengagement			-0.05		-0.05	
			(0.05)		(0.05)	
Model Statistics						
Mean Growth Rate	-1.68	***				
Growth Rate Variance	2.35	***	2.54	***	2.52	***

Notes: H-EPESE = Hispanic Established Populations for the Epidemiologic Study of the Elderly. *n* = 2,286. Shown are unstandardized coefficients with standard errors in parentheses. *p<.05, **p<.01, ***p<.001 (two-tailed tests) MMSE = Mini-Mental State Exam. ADLs = activities of daily living. CES-D = Center for Epidemiologic-Depression Scale. HS = High School.

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

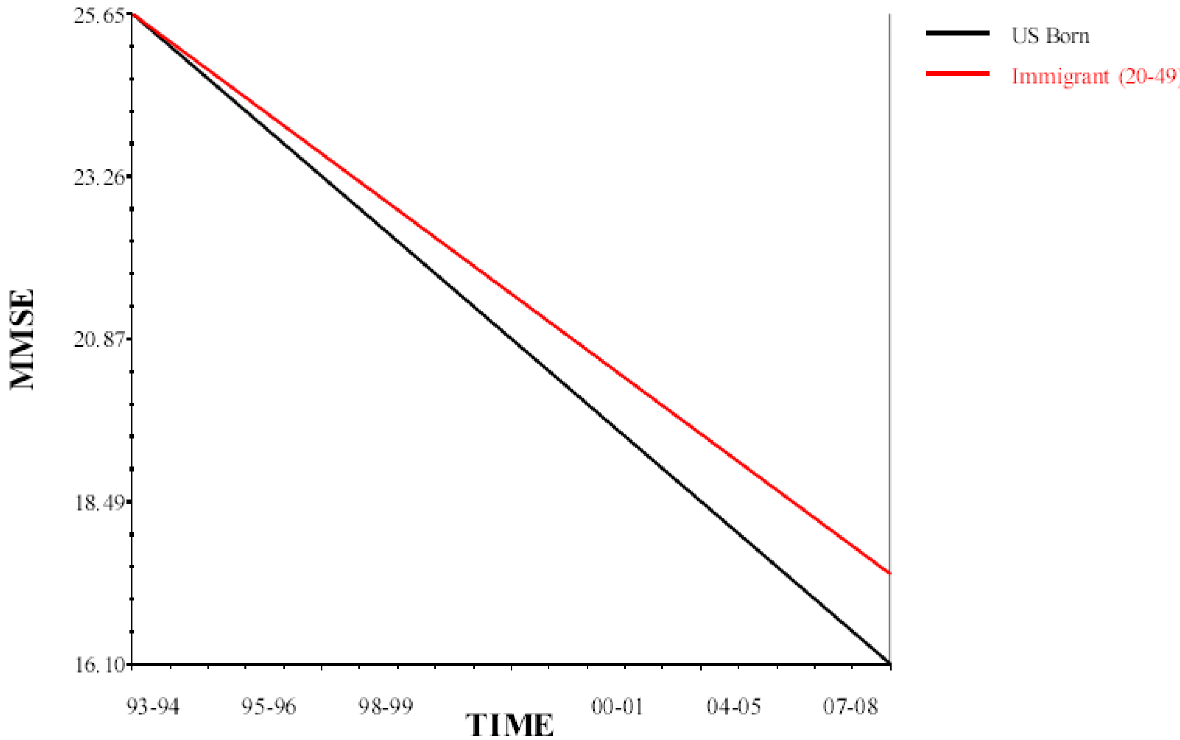

Figure 2. Cognitive Functioning Trajectories by Nativity/Age at Migration and Gender