



## Brief Report

## Proportion of life spent in the United States and cognitive functioning in Spanish-speaking migrants: Findings from the Boston Latino Aging Study

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## ABSTRACT

Latino migrants are at increased risk for cognitive decline, yet the influence of immigration-related factors, such as time lived in the United States (U.S.), remains poorly understood. In the Boston Latino Aging Study (BLAST), 130 older Latino migrants completed a comprehensive neuropsychological assessment. We examined whether the proportion of years lived in the U.S. was associated with cognitive performance, adjusting for age, education, and acculturation. Greater time in the U.S. was significantly associated with lower phonemic fluency, while no associations were found for other domains. Notably, 16 % of phonemic fluency errors involved English intrusions during a Spanish-language task, suggesting cross-linguistic interference. These findings underscore the importance of considering language dynamics and sociocultural context in studies of Latino cognitive aging.

## 1. Introduction

Alzheimer's disease (AD) presents a significant health disparity for the Hispanic/Latino/a/e/x (hereafter referred to as Latino) population [1], one that is projected to grow substantially due to the evolving demographic trends in the United States (U.S.) [2]. Although cognitive decline is a known aspect of aging, the trajectories among Latino migrants remain poorly understood. Key influences, such as cultural, environmental, and immigration-related factors, are often overlooked, despite their relevance to cognitive aging and early detection in this population.

Acculturation refers to the extent to which individuals adopt the dominant culture of their new environment [3]. Acculturation is commonly assessed through age at immigration, years of education in the U.S., language use, and adoption of cultural values and traditions, and has been linked to various health outcomes [4,5]. However, time lived in the U.S. may independently influence cognitive aging by reflecting cumulative cultural exposure, irrespective of acculturation level. Latino migrants generally have better health when they arrive in the U.S. than U.S.-born peers, though this advantage diminishes with

longer U.S. residence [6,7], a phenomenon known as the Immigrant Health Paradox, or Healthy Immigrant Effect [7,8].

Studies have examined the impact of U.S. residence duration on various health outcomes. Longer residence has been linked to adverse health outcomes, including higher rates of diabetes [9], cardiovascular risk in women [10], and mental health issues [11], yet few studies have examined its impact on cognition.

Emerging research suggests that migration-related factors influence cognitive trajectories, particularly among older adults who immigrated later in life [12]. Notably, few studies have examined how the *proportion* of life (years lived in the U.S. divided by age) spent in the U.S. impacts cognitive aging. Existing research often conflates time in the U.S. with acculturation, overlooking long-term residents who remain low in acculturation. Given that one-third of U.S. Latinos are foreign-born [13], disentangling these factors is critical for understanding AD risk.

This study draws on data from the Boston Latino Aging Study (BLAST) to investigate whether the proportion of life spent in the U.S. predicts cognitive performance in older Latino migrants. We hypothesized that greater time in the U.S. would be associated with lower cognitive performance, even after adjusting for age, education, and

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acculturation. Understanding this relationship may enhance early detection, risk stratification, and culturally responsive assessment of cognitive decline in Latino populations.

## 2. Methods

### 2.1. Participants

This study included data from the Boston Latino Aging Study (BLAST), a longitudinal cohort of Spanish-speaking adults aged 55 and older who self-identified as Latino/a/e/x. All participants were migrants (Fig. 1). Participants with a current or past diagnosis of major neurologic and psychiatric disorders, such as schizophrenia, were excluded. Participants were recruited from community centers, through word of mouth, and via advertisements (e.g., radio ads, social media).

### 2.2. Standard protocol approvals and participant consent

This research was approved by the Partners Human Research Committee, the Institutional Review Board (IRB) overseeing research compliance at Mass General Brigham (MGB). All participants provided written informed consent before undergoing any study procedures.

### 2.3. Measures

The proportion of years in the U.S. was calculated by dividing the number of years lived in the U.S. by the participant's age, providing a standardized metric of residency duration. Acculturation was measured using the Short Acculturation Scale for Hispanics (SASH) [14], a validated 12-item self-report questionnaire that assesses language use, media preferences, and ethnic social relationships.

#### 2.3.1. Neuropsychological testing

Neuropsychological assessments were completed over two visits, with testing conducted in participants' preferred language (Spanish) by trained bilingual psychometricians. Global cognition was assessed using the adapted Mini-Mental State Examination (MMSE) [15]. Cognitive status (e.g., cognitively intact, mildly impaired) was determined using MMSE scores, with education-adjusted cutoff scores as follows: <15 for

individuals with no formal education; <20 for 0.5–3 years; <23 for 4–6 years; <25 for 7–9 years; and <26 for 10 or more years of education. Non-verbal reasoning was assessed with the Matrix Reasoning subtest from the Spanish Wechsler Adult Intelligence Scale-Fourth Edition (WAIS-IV) [16]. Phonemic fluency was measured with the PMR subtests of the Bateria Neuropsicológica en Español (BNE) [17], with errors coded for rule violations, including intrusions, perseverations, and off-task responses. Semantic fluency (Animals) and verbal serial list learning (Word List) were measured using the NEUROPSI Atención y Memoria, 3rd edition [18].

### 2.4. Statistical analysis

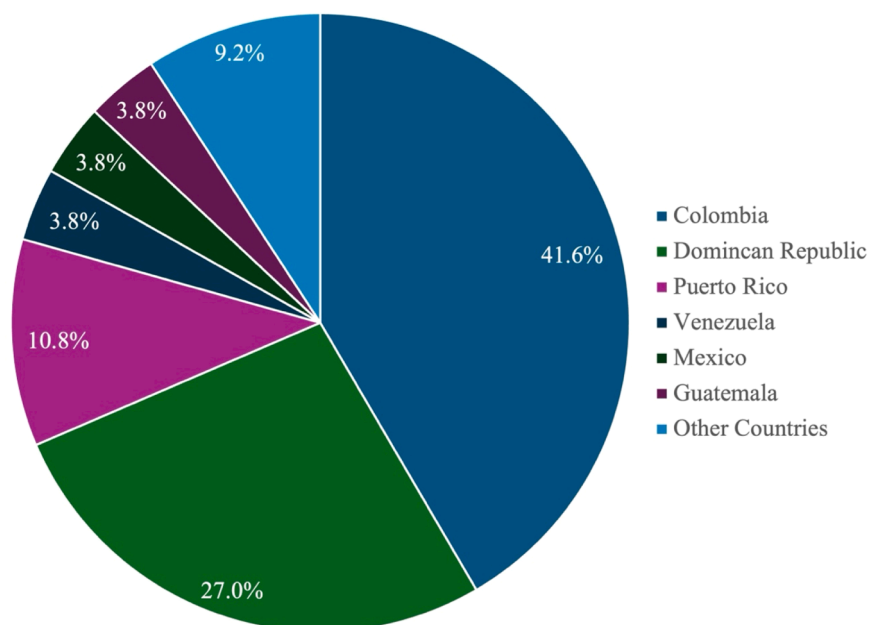
Analyses were conducted in SPSS (version 29) using separate linear regression models to examine associations between the proportion of years in the U.S. and cognitive performance (MMSE, PMR, Animals, Matrix Reasoning, and List Learning Test). Visualizations were performed in R (version 4.5.0). All models included age, education, and acculturation as covariates. Assumptions were met, significance was set at  $p < .05$ , and effect sizes ( $R^2$ ) were reported.

## 3. Results

The sample included 130 non-demented adults with a mean age of 68.39 years ( $SD = 8.34$ ; range = 55–89) and a mean educational attainment of 10.64 years ( $SD = 4.58$ ; range = 1–20), 75 % of whom were females ( $n = 97$ ). As shown in Table 1, participants were predominantly low in acculturation based on SASH scores [14], and 98 % reported Spanish as their primary spoken language. The mean MMSE score was 26.03 ( $SD = 3.19$ ). Based on education-adjusted cutoffs, 97 participants were classified as cognitively intact and 33 as mildly impaired.

### 3.1. Associations between proportion of years of U.S. residence and cognition

A higher proportion of years lived in the U.S. was significantly associated with lower phonemic fluency ( $\beta = -14.60$ ,  $p = .002$ ), explaining 42 % of the variance ( $R^2 = 0.42$ ). No significant associations



**Fig. 1.** Percentage of participants by country of origin in the current sample. “Other Countries” includes Peru (2.3 %), Costa Rica (1.5 %), Honduras (1.5 %), El Salvador (1.5 %), Ecuador (0.8 %), Panama (0.8 %), and Paraguay (0.8 %).

**Table 1**

Demographic and cognitive characteristics of the sample.

Characteristic	Mean	SD
Age (years)	68.39	8.34
Education (years)	10.64	4.58
Proportion of years in U.S.	0.42	0.21
Acculturation level <sup>a</sup>	1.65	0.57
Global Cognition (MMSE)	26.03	3.19
Phonemic Fluency (PMR)	32.42	13.29
Semantic Fluency (Animals)	15.44	4.75
Word List (Delayed Recall)	4.98	2.98
Abstract Reasoning (Matrix Reasoning)	8.81	4.44

Note. MMSE = Mini-Mental State Examination.

<sup>a</sup> Measured using the Short Acculturation Scale for Hispanics (SASH) [14]. Based on the SASH measure, scores ranging from 1.0 to 2.4 are commonly interpreted as indicating low acculturation or Spanish dominance, reflecting limited integration into U.S. mainstream culture. Using education-adjusted MMSE cutoffs, 97 participants were classified as cognitively intact and 33 as mildly impaired. Scores represent raw performance on each neuropsychological measure. Higher scores reflect better performance.

were found for global cognition ( $\beta = 1.74, p = .14$ ), semantic fluency ( $\beta = -3.36, p = .078$ ), non-verbal abstract reasoning ( $\beta = -2.71, p = .11$ ) or verbal serial list learning ( $\beta = -1.18, p = .30$ ) (Fig. 2).

**Sensitivity Analysis.** Given the relationship between age and the proportion of years spent in the U.S., we conducted a sensitivity analysis excluding age as a covariate to evaluate potential multicollinearity effects. The results remained consistent with the main analyses: the proportion of years in the U. S. significantly predicted letter fluency ( $\beta = -15.63, p = .002$ ), while associations with global cognition, semantic

fluency, episodic memory, and abstract reasoning remained non-significant. Multicollinearity was assessed using variance inflation factors (VIFs). All VIFs were below 2.

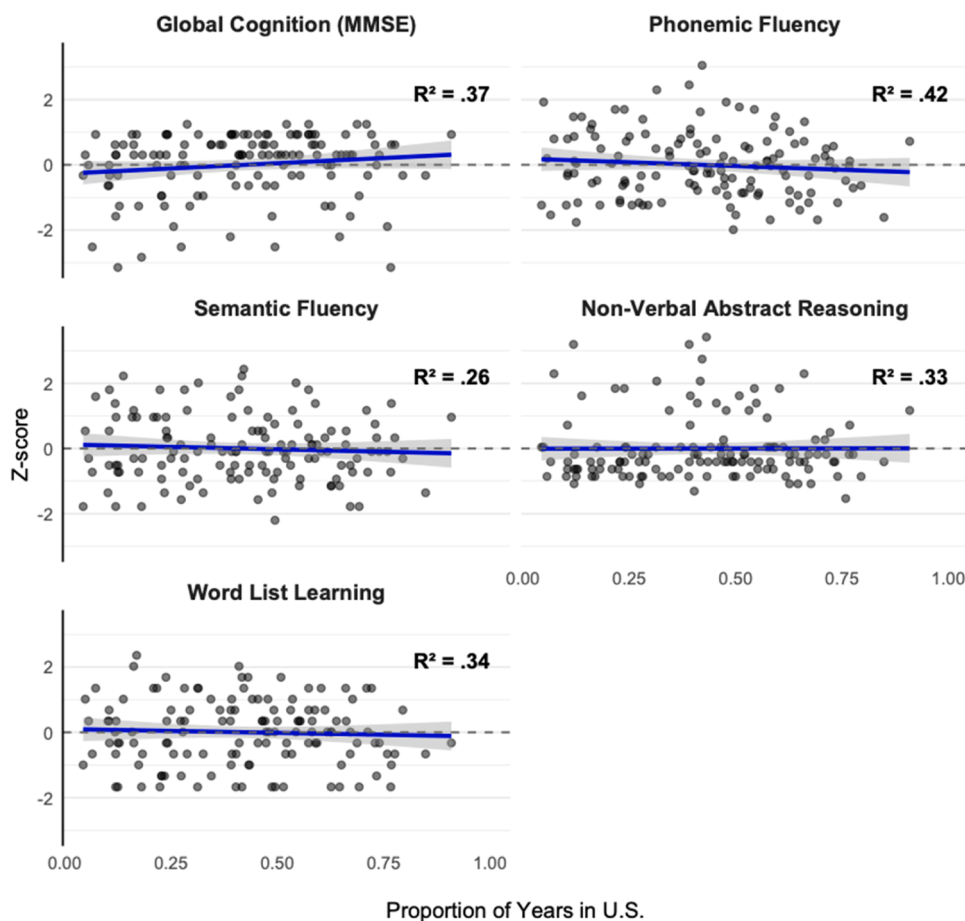
### 3.2. Qualitative analysis

Qualitative analysis of phonemic fluency errors revealed that 16 % were language intrusions, where participants used English words despite being instructed to respond in Spanish (e.g., “pencil” for the letter “P”). The number of total phonemic fluency errors was 217, and those that were specifically language intrusion errors were 34.

## 4. Discussion

A higher proportion of years spent in the U.S. was associated with lower phonemic fluency, even after adjusting for age, education, and acculturation, suggesting that extended U.S. residency may influence phonemic fluency and executive functioning. No significant associations were found with global cognition, semantic fluency, list learning, or nonverbal abstract reasoning. This domain-specific effect may reflect socio-cultural and language-related factors that uniquely influence word generation and retrieval, a task that depends heavily on executive function and linguistic processes [19–21].

The observed decline in phonemic fluency with longer U.S. residency may reflect cumulative sociocultural factors such as occupational changes and shifts in social roles rather than biological aging alone [22–24]. These findings align with the Immigrant Health Paradox, which posits that health advantages among migrants diminish over time due to chronic stress and social strain [25–27]. Notably, 16 % of



**Fig. 2.** Linear regression models examined the association between proportion of life spent in the U.S. and each cognitive domain.  $R^2$  values are displayed to indicate the proportion of variance explained.

phonemic fluency errors involved English intrusions during a Spanish task, despite most participants being Spanish-dominant. These cross-language errors suggest bilingual language interference or lexical borrowing, reflecting adaptive language processing rather than impairment [30]. Larger studies should examine whether a longer proportion of life in the US is associated with adaptive language processing.

Recent findings support this distinction. English language proficiency and frequency of use have been found to be associated with improved letter fluency performances over time among Spanish-dominant bilinguals [31], suggesting that language proficiency and use patterns can positively shape cognitive outcomes. These findings underscore the importance of considering language use patterns and proficiency when interpreting verbal fluency in bilingual individuals.

Although broader executive functioning was considered, other measures in our study (e.g., nonverbal abstract reasoning, list learning) were not significantly affected. This suggests that phonemic fluency may be particularly sensitive to subtle executive or language retrieval differences, rather than reflecting global impairment. Importantly, previous studies have reported mixed findings regarding phonemic fluency [28,29], further highlighting how bilingualism, language dominance, and acculturation can influence test performance independently of neurocognitive status. A marginal trend was observed for semantic fluency, but it did not reach statistical significance. No effects were found for nonverbal abstract reasoning or verbal serial list learning, cognitive domains less influenced by language, consistent with previous research [12]. These findings suggest a need to explore alternative fluency scoring methods that do not penalize responses in multiple languages.

Previous studies have often used composite or summary acculturation scores that obscure the distinct impacts of linguistic exposure versus broader cultural integration. The present study contributes to the growing body of research exemplifying the need to evaluate context acculturation measures, such as time spent in the U.S., separately from behavioral or attitudinal assimilation. While we adjusted for acculturation using the SASH scale, our results suggest that years lived in the U.S. residency may capture a different aspect of cultural adaptation not reflected by traditional acculturation scales. This is supported by recent research showing that language proficiency and usage independently relate to cognitive change in older Latino adults [31,32].

Moreover, these findings are consistent with broader models of acculturation in context, which emphasize the role of environmental, social, and linguistic factors [5,6]. The lack of associations with other cognitive domains underscores the specific vulnerability of verbal fluency to sociolinguistic influences. Previous research has also shown that birthplace and age at migration shape cognitive trajectories [26].

These findings highlight the need to consider language use and broader social determinants in understanding cognitive aging in Latino migrants. Several limitations warrant discussion. First, the cross-sectional design limits causal inference, and the modest sample size and low variability in acculturation may limit generalizability. Second, although the study adjusted for key covariates (e.g., age, education, acculturation), it did not account for additional factors such as income, insurance status, or cardiovascular health, which may influence cognitive outcomes. Third, acculturation was examined using the SASH total scores. However, this approach may obscure domain-specific influences, particularly those related to language. And finally, the proportion of years in the U.S. does not capture non-linear migration histories (e.g., temporary departures), which may affect cultural exposure. Future research should explore how linguistic environments, chronic stressors (e.g., acculturation stress, discrimination), access to community resources, family support, and neighborhood contexts interact to shape cognitive outcomes in this population.

In conclusion, this study adds to the growing literature on cognitive aging among Latino migrants by highlighting the complex interplay between acculturation, linguistic exposure, and sociocultural factors. Our findings suggest that longer U.S. residency or other factors such as

bilingualism, that may shape cognitive trajectories. Longitudinal research is needed to clarify how immigration-related experiences, including early life conditions, discrimination, and access to healthcare impact cognition over time. These insights can guide culturally and linguistically appropriate assessments and interventions, ultimately supporting more equitable cognitive health outcomes for aging Latino migrants.

## CRediT authorship contribution statement

**Isabel Solis:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Randy Medrano:** Writing – review & editing, Investigation, Data curation. **Lusiana Martinez:** Writing – review & editing, Investigation, Data curation. **Nadeshka J. Ramirez:** Writing – review & editing, Investigation, Data curation. **Nikole A. Bonillas Felix:** Writing – review & editing, Investigation, Data curation. **Jorge Alcina:** Writing – review & editing, Investigation, Data curation. **Averi Giudicessi:** Writing – review & editing, Investigation, Data curation. **Jairo E. Martinez:** Writing – review & editing, Investigation, Data curation. **Clara Vila-Castelar:** Writing – review & editing, Investigation, Data curation. **Liliana A. Ramirez-Gomez:** Writing – review & editing, Investigation, Data curation. **Marta Gonzalez Catalan:** Writing – review & editing, Investigation, Data curation. **Daniel G. Saldana:** Writing – review & editing, Investigation, Data curation. **Yakeel T. Quiroz:** Writing – review & editing, Supervision, Resources, Project administration, Investigation, Funding acquisition, Conceptualization.

## Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Yakeel T. Quiroz reports financial support was provided by National Institutes of Health. Yakeel T. Quiroz reports financial support was provided by MGH ECOR. Yakeel T. Quiroz reports a relationship with Biogen Inc that includes: consulting or advisory. Clara Vila-Castelar reports a relationship with National Institute on Aging that includes: funding grants. Clara Vila-Castelar reports a relationship with Know Neuropsychology that includes: speaking and lecture fees. Other authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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