Biculturalism, Bilingualism, & Executive Function Among U.S. Latinos: Implications for Cognitive Reserve

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BICULTURALISM, BILINGUALISM, & EXECUTIVE FUNCTION AMONG U.S. LATINOS: IMPLICATIONS FOR COGNITIVE RESERVE

by

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ABSTRACT
BICULTURALISM, BILINGUALISM, & EXECUTIVE FUNCTION AMONG U.S. LATINOS: IMPLICATIONS FOR COGNITIVE RESERVE

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The current study was an exploratory investigation of the cultural constructs of biculturalism and bilingualism as predictors of executive function among a community-based sample of 25 older adult Latinos living in the U.S. The potential moderating effects of education and bicultural identity integration were also examined. Using regression analyses, biculturalism and bilingualism were examined independently as predictors of performance on three separate tasks of executive function: trail making tests, a phonemic fluency task, and a clock drawing task. Bilingualism was not found to predict performance on any of the executive functioning tasks. In the overall sample, biculturalism also was not found to predict performance on tasks of executive function. Additional analyses; however, revealed that among women in the sample, biculturalism was predictive of better performance on a phonemic fluency task, specifically among those who were high in cultural harmony, an aspect of bicultural identity integration. Also noteworthy was the finding that biculturalism was actually related to worse phonemic fluency performance among non U.S. educated individuals, contrary to stated hypotheses. Findings are discussed within the framework of cognitive reserve theory. This is the first study to examine biculturalism as a potential predictor of executive functioning and the first to suggest that biculturalism may contribute to cognitive reserve. The study highlights the complexities of examining cultural variables in cognition research, as well as the need for future work in this area.

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Introduction

Latinos currently account for 17.6% of the total U.S. population (Flores, 2017) and are expected to represent 31% of the nation's population by the year 2060 (U.S. Census Bureau, 2014). In addition, by the year 2030, older adults, or those over age 65, are expected to represent 19% of the total U.S. population, an increase from 12.9% in 2009 (Administration on Aging, 2014) with a greater projected life expectancy than any other racial/ethnic group (Arias, 2014). Despite these demographics, Latinos are not well represented in aging research, particularly as it relates to aging and cognition (Díaz-Venegas, Downer, Langa, & Wong, 2016). As cognitive decline is a major area of concern for an aging population, research specific to cognition, aging, and Latinos is critical. While some cognitive change, such as gradual declines in executive functioning, processing speed and new learning (Harada, Love, & Triebel, 2014) are considered a normal part of aging, significant declines are not part of the normal aging process. Among the top etiologies for abnormal cognitive decline is that of Alzheimer's disease (AD), the sixth leading cause of death in the U.S., with increased age being the single most significant risk factor for the development of the disease (Alzheimer's Association, 2007). Thus, it is expected that the growth in the U.S. Latino older adult population will be matched with a significant increase in AD prevalence rates among Latinos living in the U.S. (Alvarez, Rengifo, Emrani, & Gallagher-Thompson, 2014). In fact, it is projected that by the year 2050 there will be a 600% growth in the number of U.S. Latinos with AD (Alzheimer's Association, 2007). Furthermore, Latinos have high rates of diabetes and other cardiovascular diseases (Haan et al., 2003), and on average, fewer

years of formal education, all of which increase risk not only for AD, but other dementias as well (Fargo & Bleiler, 2014).

As stated by Ardila (2007), "culture prescribes what should be learned, by what age, and by which gender" (p. 27). Thus, what is relevant in one cultural context may not be in another, thereby altering the development and honing of certain cognitive skills. This is perhaps best explained by the theory of *cultural brain plasticity*, which refers to "functional and structural changes in the human brain, due to exposure to different cultures" (Hong & Khei, 2014, p.29). As Latinos living in the U.S., an individual's heritage culture and mainstream American culture may each impact cognition in their own way. Therefore, when examining cognition within a particular cultural group (i.e., Latinos), cultural factors are of the utmost importance to consider.

Language, specifically bilingualism, is one aspect of culture that has been considered in the cognition research. Bilingualism has been found to predict better outcomes on executive functioning tasks throughout the lifetime (Colzato, Bajo, Wildenberg, & Paolieri, 2008). Within the context of aging and dementia processes, it has also been posited that via improved cognitive flexibility, bilingualism ultimately contributes to cognitive reserve (Guzmán-Vélez and Tranel (2014). *Cognitive reserve* refers to the ability of the brain to cope with damage in order to minimize expressed symptomatology (Stern, 2002). While not previously examined within cognition research, it may be that biculturalism, a complex identity development process that occurs as a result of exposure to, and identification with two cultures (Ramírez-Esparza & García-Sierra, 2014), may also improve aspects of cognition and contribute to cognitive reserve. That is to say, like bilingualism, biculturalism requires the maintenance and switching

between two systems dependent on the context. Therefore, over time the practiced inhibition and switching process may cultivate increased cognitive flexibility and inhibitory control, which may then ultimately contribute to cognitive reserve. Thus, the ideas of cultural brain plasticity and cognitive reserve can help inform research on cognitive aging among Latinos that extends beyond bilingualism.

Executive Functioning

Executive functioning is an umbrella term for a set of cognitive processes that include behavioral inhibition, planning, reasoning, cognitive flexibility, and working memory (Duff, Schoenberg, Scott, & Adams, 2005; Miyake et al., 2000). It is thought that executive functions are among the first to decline in the normal aging process (Bryan and Luszcz, 2002). In addition, executive functioning is particularly important as it is these skills that allow a person to independently navigate their environment (Harada, et al., 2013). Further, it has been suggested that executive functioning may be the mechanism by which cognitive reserve develops by allowing for more flexibility in cognitive processes (Tucker & Stern, 2011). For example, there is ample research to suggest that bilingualism is related to better executive function throughout the lifespan (Bialystok, 2007 Bialystok, Craik, Green, & Gollan, 2009; Costa, Hernández, Costa-Faidella, & Sebastián-Gallés, 2009), and that in turn may contribute to greater cognitive reserve (Gold, 2015).

Dementia among U.S. Latinos

While risk factors for cognitive decline are not unique among Latinos, the high rates at which U.S. Latinos experience a combination of risk factors is concerning. For

example, the diagnosis of mild neurocognitive disorder, which often is a precursor to dementia, has been found to be as much as two times greater among Latinos as compared to age-matched non-Hispanic whites (Alzheimer's Association, 2010). Also, as previously mentioned, Latinos have the highest life expectancy, and age is the most significant risk factor for AD with the likelihood of developing AD doubling every five years after the age of 65 (Fargo & Bleiler, 2014). Additionally, U.S. Latinos experience high rates of diabetes, high blood pressure, and high cholesterol. These increased risk factors may help explain why U.S. Latinos are 1.5 as likely as their non-Hispanic white counterparts to have AD (Fargo and Bleiler, 2014).

In addition to the high risk of AD for U.S. Latinos, age of onset, and course of AD may be distinct among U.S. Latinos. Compared to African Americans and non-Hispanic whites; Latinos, who were mostly of Puerto Rican descent, were found to have an earlier age of onset of AD, more cognitive impairment with greater severity, as well as higher rates of depression in both the AD and control group (Livney et al., 2011). Similarly, Fitten and colleagues (2014) found the age of diagnosis of AD and other dementias to be four years younger among Latinos when compared to non-Hispanic white participants. These effects were observed even after controlling for education, gender, and dementia severity. Despite the earlier onset and greater severity of symptoms, a national study using data from more than 30 AD centers in the U.S. found that Latinos and African Americans lived longer after being diagnosed with AD when compared to their white counterparts. Postmortem neuropathology findings did not show differences in the pathology of the brain by race/ethnicity among those who had a diagnosis of AD (Mehta, et al., 2008), indicating that from a neurological perspective, the

progression of the disease within the brain is a common factor. That is to say, despite significant variations in the time of onset and manifestations of AD symptoms, the brain changes that occur in AD appear to be universal.

It may seem that such significant brain changes would inevitably lead to the cognitive decline; however, as previously described, neuropathology does not necessarily correlate with level of impairment. Variability in symptomatology among individuals with similar levels of brain pathology were first discovered over twenty years ago when the brains of 20% of a sample of women who were cognitively normal at the time of death, had enough damage to meet criteria for AD (Katzman, et al., 1989). It has more recently been estimated that as many as 30% of individuals who are found to have significant AD pathology in the brain at autopsy do not show symptoms of cognitive impairment during their lifetime (Valenzuela & Sachdev, 2006). The individual variability in functioning among those with significant neuropathology suggests that for some, the brain compensates for the damage, allowing the individual remain cognitively intact.

Cognitive reserve

Cognitive reserve is thought to be acquired through prolonged complex mental activity; in the form of intellectual, social, and physical activity. The theory of cognitive reserve suggests that engaging in such activities causes the brain to change in such a way that it can be protective with respect to the onset of symptoms and decline in neuropathology. That is to say, even in the presence of severe brain pathology the outward manifestation of symptoms is significantly delayed or even avoided altogether (Scarmeas & Stern, 2004; Stern, 2002; Stern, 2003; Stern, 2012). Methodological

approaches assessing both cognitive functioning and neuropathological indicators via imaging techniques have found support for cognitive reserve theory. Individuals with greater indicators of reserve, such as those who have more years of education, perform better cognitively, despite having more significant pathology present in the brain (Alexander, et al., 1997; Schweizer, Ware, Fischer, Craik, and Bialystok, 2012; Stern, et al., 1995). As much of the research on cognitive reserve has been studied within AD, and given the high risk of AD among Latinos, the current review will largely focus on AD research, although it should be noted that cognitive reserve is not limited to AD or other dementia processes (Roldán-Tapia, García, Cánovas, & León, 2012).

Education. It has been suggested that people with fewer years of education are at a higher risk for dementia, while those with more years of education are thought to have more cognitive reserve (Fargo & Bleiler, 2014). In fact, education is the most commonly used indicator of cognitive reserve (Jones, Manly, Glymour, Renz, Jefferson, & Stern, 2011). However, findings on the relationship between education level and dementia are controversial (Baldivia, Andrade, & Bueno, 2008). While several studies have in fact demonstrated a protective effect of greater education for both AD incidence and prevalence (Valenzuela & Sachdev, 2006), other studies have not found this effect to be true. For example, a national study using participants from more than 30 AD research centers reported onset of AD symptoms as being slightly earlier among participants with more education (Roe, Xiong, Grant, Miller, & Morris, 2008).

In a review of several international studies that examined the relationship between AD and education, the authors concluded that the relationship between education and dementia was “ambiguous, at best” (Gilleard, 1997). Almost 15 years later, another

review of the available data on education and dementia that examined AD independently, concluded that education does not uniformly protect against AD and that this relationship is likely more complex than what has been previously suggested (Sharp & Gatz, 2011). These discrepancies in findings are likely due in part to variability in the operationalization of education. For example, whereas some studies may conceptualize education as a continuous variable based on years of schooling completed (Roe et al., 2008) others use it categorically using numerical cut-offs and creating groups based on those cut-offs (Ravaglia et al., 2002). Further, definitions of low education have varied from illiterate to less than 15 years of education, while high education has included literacy to having more than 17 years of education (Sharp & Gatz, 2011).

Additionally, when years of schooling is used as a measure of education, there is an underlying assumption that the educational experience is equivalent across individuals (Baldivia, Andrade, & Bueno, 2008). Yet differences in quality of education vary considerably within the U.S. and certainly between countries as well (Manly & Mayuex, 2004). Thus, 15 years of education for one individual may represent a very different experience than that of another individual with the same years of formal schooling. Some researchers have suggested that using reading level as a proxy for educational quality may be a better indicator of educational attainment, as opposed to number of years of schooling, especially among ethnic minority individuals (Cosentino, Manly, & Mungas, 2007; Manly, Jacobs, Tourjadi, Small, & Stern, 2002). Evidence suggests that literacy at baseline is a better predictor of decline in memory and executive functioning (Manly, Schupf, Tang, & Stern; 2005). Unfortunately, tests of reading ability that have been used as indictors of education are in English and have been developed specifically for English-

speaking individuals, thus making their applicability to Latinos whose primarily language is Spanish, or another language, difficult. Another methodological factor to consider in studies of education and cognitive functioning is the outcome being studied (e.g., age of symptom onset among clinical samples and incidence among case-control studies). These varying outcome measures may also explain some of the variability in findings on the relationship between education and cognitive decline.

A final important consideration to make regarding the relationship between education and cognitive change is the unique characteristics of the populations studied. For example, a study from Mexico found that low education was related to dementia risk only in an urban, but not a rural group (Rodríguez, et al., 2008). Sharp and Gatz (2011) suggest that findings such as that of Rodríguez, et al. (2008) indicate that years of education may represent separate constructs across individuals. While for some, higher education may be an indicator of greater interest in learning or an inclination toward cognitively stimulating activity, others may not have had the opportunity for education. Therefore, in some cases years of education is more reflective of circumstances and privilege, or lack thereof (Sharp & Gatz, 2011). Thus, although it may seemingly appear to be straightforward, education is a challenging construct to measure, making it difficult to make any generalizations based on the available research on education and cognitive reserve. It can be said that in at least some cases, education is protective for cognitive decline, but the nuances of that relationship have yet to be determined. Thus, it is important to continue to explore education as a contributor to cognitive reserve to help elucidate the relationship. Research among U.S. Latinos is particularly important given that the state of U.S. Latino education has been described as being at a crisis point, with

considerably low high school completion rates as well as poor educational quality (Young, Lakin, Courtney, & Martiniello, 2012).

Bilingualism. Broadly speaking, bilingualism refers to one's ability to speak two languages (Ramírez-Esparza & Garcia-Sierra, 2014). In a recent review, Guzmán-Vélez and Tramel (2014) suggested that there is sufficient evidence that bilingualism contributes to cognitive reserve as a result of more efficient use of brain resources, which then delays the onset of AD symptomatology. Bialystok, Craik, and Freedman (2007) examined 184 patients who were referred to a memory clinic in Toronto, Canada. Most participants (n=132) were diagnosed with probable AD based on National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association (NINCDS- ADRDA) criteria. The remaining participants were diagnosed with other dementias, including possible AD, dementia due to other neurocognitive disorders, and cerebrovascular disease. The sample consisted of 91 monolingual individuals and 93 bilingual individuals. Monolingualism versus bilingualism was determined by a group of blind judges who were given information regarding the languages spoken by individuals, English fluency, place of birth, age, and year of immigration to Canada. For someone to be considered bilingual the 11 judges had to agree that the individual had spent the majority of his or her life regularly using at least two languages. A total of 25 different English-other language bilingual groups were included. Monolinguals versus bilinguals were compared based on age of diagnosis (determined by family member reports) and rate of decline (as assessed by declines in performance over time on the Mini Mental State Examination (MMSE) (Folstein, 1975).

Findings indicated that the onset of dementia symptoms among bilingual participants, as compared to monolingual individuals, was delayed by 4.1 years.

Chertkow and colleagues (2010) attempted to replicate Bialystok's findings using a larger sample and addressing some of the limitations of the first study. Chertkow et al. (2010) included only participants with a diagnosis of probable AD. Second, they created groups based not only on language, but also on immigration status in order to account for differences based on nativity and migratory experience. The sample included 632 individuals who had been diagnosed exclusively with probable AD and were grouped according to being nonimmigrants whose first language was English, nonimmigrants whose first language was French, and an immigrant group. Each of those groups was further categorized into unilingual versus bi-or multilingual participants. The primary criterion for an individual to be considered bilingual was the same as Bialystok's (2007) aforementioned criteria. When comparing age of onset between the monolingual and bilingual participants regardless of immigration status, Bialystok's (2007) findings were only partially supported. Initial analyses did not support a later age of onset of AD for bilinguals as compared to monolinguals. However, when analyzing only the immigrant subgroup, a bilingual advantage was found such that diagnosis was given on average five years later among the bilingual group. When examining the sample as a whole, there was a statistically significant delay in symptom onset among those in the multilingual group as compared to the bilingual and monolingual groups.

Craik, Bialystok, and Freedman (2010) conducted a study with 211 patients who were diagnosed with probable AD, based on NINCD-ADRD criteria, at a memory clinic in Toronto, Canada. Age of onset of cognitive impairment was determined by patient and

caregiver reports upon first visiting the clinic. Using the same criteria for bilingualism as the prior studies, 102 patients were identified as being bilingual. There were 21 English-other language bilingual combinations included with the most common languages being Yiddish, Polish, Italian, Hungarian, and French. The bilingual participant group was composed of 79% immigrants while the monolingual group consisted of 32% immigrants. Results indicated that the average age of onset of symptoms was 77.7 years for bilinguals and 72.6 for monolinguals, a statistically significant difference of 5.1 years, despite monolingual participants having reported significantly more years of formal education than bilinguals (12.6 as compared to 10.6 years). Due to the difference in the immigration status of the groups, post-hoc analyses were conducted, yet no differences by immigration status were reported.

Schweizer et al. (2012) were the first to include neuroimaging techniques in the work on bilingualism and cognitive reserve. The researchers examined differences in brain atrophy among 20 bilingual and 20 monolingual individuals diagnosed with probable AD. Bilingualism was determined by asking participants and a significant other (when available) if the participant was fluent in a second language, and whether they used both languages regularly throughout their lifetime. Participants were matched according to performance on cognitive measures as well as demographic variables. CT scans revealed that bilingual speakers showed significantly greater atrophy in brain areas associated with AD, after being matched on cognitive functioning and years of education. These differences were observed only in brain areas associated with AD. Thus, the findings indicate that bilingual individuals, despite having greater atrophy of the brain,

are no more impaired than their monolingual counterparts, lending support to the idea of bilingualism contributing to cognitive reserve.

Alladi et al. (2013) studied the records of a total of 648 patients with dementia who presented to a memory clinic in Hyderabad, India. Age of onset of dementia symptoms was compared in bilingual versus monolingual participants for several types of dementia. Bilingual individuals were defined as, "those with the ability to meet the communicative demands of the self, and the society in their normal functioning in two or more languages in their interaction with other speakers of any or all of these languages" (Alladi et al., 2013, p. 1939). Thus, some individuals in the bilingual group were actually multilingual. Age of onset was determined by a healthcare assessment, not self-report. The results indicated that the bilingual group was on average 4.5 years older than the monolingual group at the time of the first noted symptoms of dementia. Unlike the findings from Chertkow et al. (2010), there was not a significant difference in the age of onset with an increased number of languages spoken. Additionally, the bilingual group in this study had significantly more men, more years of education, and more skill demanding professions as compared to the monolingual group. Follow up analyses did not find any significant effects of any of those variables. It is noteworthy that immigrant cases were not included in the study, thus eliminating the potential confounding effects of immigration on the findings.

Each of the studies that have been reviewed has been conducted outside of the United States and most have included multiple English-other language bilingual groups. Studies that have focused exclusively on Latinos living in the U.S. who are English-Spanish bilinguals are limited. Of the studies that have been conducted only one found a

protective effect of bilingualism for delayed age of onset of AD symptom presentation. Gollan, Salmon, Montoya, and Galasko (2011) examined the relationship between bilingualism and onset of probable AD among 44 Latino English-Spanish bilinguals. Half of the participants were evaluated in Spanish, and the other half in English (based on participant preferences). Degree of bilingualism was obtained by calculating a bilingual index score based on performance in the two languages on a picture-naming test. Thus, bilingualism was operationalized as a continuous, rather than a dichotomous variable as has been done in other studies on bilingualism and cognitive reserve (Alladi et al., 2013, Bialystok et al., 2007; Chertkow et al., 2010, Craik et al., 2010). Age of onset was determined by the age of diagnosis as opposed to reports of age on onset of symptoms as reported by a family member, in an attempt to use objectively determined clinical classifications. The findings suggest that there is an interaction between bilingualism and education, such that higher degrees of bilingualism were associated with a later age of onset of probable AD, but was significantly more robust among the lower educated participants. Additionally, although all participants identified as being bilingual to some degree, the majority of participants with later age of onset were Spanish-dominant (73%). Furthermore, the results were significant only when using objective, naming ability bilingualism scores, and not self-reported bilingualism. The results suggest that there may be an upper limit to which cognitive reserve can delay symptoms of AD, such as in the case of an individual who has obtained a high level of education and is also bilingual.

In a Spanish-English bilingual immigrant group, Zahdone, Schofield, Farrell, Stern, and Manly (2014) did not find a relationship between bilingualism and age of AD onset. Participants included 1,067 immigrants living in a Spanish-speaking enclave of

northern Manhattan who were primarily from the Caribbean and were part of the Washington/Hamilton Heights Inwood Columbia Project, a longitudinal, community based study of aging and dementia. All participants had been born and raised in Spanish-speaking countries, spoke Spanish as their first language, and considered Spanish to be their primary language. Spanish language fluency was corroborated via interviews conducted in Spanish. English language ability was assessed based on self-report and an objective measure. Using a 4-point Likert scale, participants indicated whether they spoke English very well, well, not well, or not at all. Those who indicated that they did not know English at all were grouped into the monolingual group. Self-reports of English ability correlated with performance on the Wide Range Achievement Test-Version 3 (WRAT-3). Participants did not meet criteria for dementia during initial participation in the study. Over a 23-year time period 26% of the sample went on to develop some type of dementia, with no difference between the monolingual and bilingual groups. Furthermore, age of onset was not found to vary by language group. Differences were found only by education, where more years of education was found to be related to delayed onset of dementia.

Of note, the sample in the work of Zahdone et al. (2014) is described as being derived from a "Spanish speaking enclave in Manhattan." Thus, although these individuals may be bilingual, their frequency of use of both languages may be limited depending on individual differences in daily activities and extent of contact made with others outside of the "Spanish speaking enclave" who perhaps are non Spanish speaking. Having the knowledge of a second language, but not using it likely impacts its potential

to contribute to cognitive reserve, which may, at least in part, account for the lack of finding a significant effect of bilingualism and age of onset.

In a recent study of 53 monolinguals (76% Spanish speaking) and 27 Spanish-English bilingual Hispanics, age of clinically diagnosed dementia (AD and vascular dementia) was not found to differ among bilingual and monolingual participants (Lawton, Gasoquine, & Weimer, 2015). Data were derived from the Sacramento Area Latino Study on Aging, a longitudinal study with a random sampling of community dwelling Hispanic Americans. Participants of the current study included dementia cases that had been identified at yearly-follow up between 1998-2008. Average age of diagnosis was 81.10 years among bilinguals as compared to 79.31 in monolinguals, but this difference was not statistically significant. Bilingualism was determined based on the questions "Do you speak Spanish?" and "Do you speak English?" (Lawton et al., 2015). Rather than using subjective reports of onset of symptoms, time of clinical diagnosis was used, a representing a significant strength of the study. However, grouping monolingual and bilingual participants based on two self-report items is a significant limitation. Further, the small sample size and unequal groups may have impacted results, decreasing the likelihood of finding a significant effect.

The discrepancies in findings on bilingualism and dementia within U.S. Latinos are important to consider and highlight the complexity of evaluating a construct like bilingualism within the context of cognitive reserve. Despite inconsistencies in the research on bilingualism and dementia among Spanish-English bilingual Latinos in the U.S., there is some evidence in support of this relationship within this population (Gollan et al., 2011), in addition to support from other bilinguals in Canada and India (Alladi et

al., 2013, Bialystok et al., 2007, Chertkow et al., 2010, Craik et al., 2010, Guzmán-Vélez & Tranel, 2014). Thus, like education, more research is needed on bilingualism that takes into account the social context with which languages are spoken, the length of time in which one has been fluent in both languages, the frequency of use of the languages, as well as individual proficiency in each language. Watson, Manly, & Zahdone (2016) recommend taking a rigorous methodological approach to the bilingualism/cognitive aging relationship that would allow for better understanding of the "complex interactions between culture, cognition, and the brain" (pp.601).

Biculturalism

Research on bilingualism and cognition most often refers to someone who speaks two languages and gives no indication of the cultural context in which the mastery of two languages was achieved and how or if it continues to be maintained. Although some bilingual individuals are monocultural, or, have most likely learned a second language via direct instruction and have not been immersed in and do not identify with the culture of the second language, others are bicultural. Bicultural bilinguals are those who have been exposed to and identify with the corresponding cultures of the languages that they speak (Ramírez-Esparza & García-Sierra, 2014). Further, the identification with each of the two cultures is often very salient to the individual's self-concept. Interestingly, many bicultural bilinguals report feeling like a different person and experiencing a shift in personality depending on the language being spoken (Ramírez-Esparza & García-Sierra, 2014).

As it relates to Latinos living in the United States, bilingualism may involve exposure to a bicultural environment (e.g., ethnic culture at home, mainstream U.S.

culture in other settings), however the richness of the environment also varies significantly. For example, at one extreme, some bilingual biculturals may live in neighborhoods in which they are immersed in their heritage culture. Neighborhoods such as Chicago's *Little Village*, also known as the *Mexico of the Midwest* (Chicago City and Neighborhood guide, 2010) or Miami's *Little Havana* (Pérez, 1992) are not uncommon in parts of the country with high Latino populations. In ethnic enclaves such as these, exposure to the mainstream U.S. culture may be more limited (Rudolph, 2011). On the other hand, there are bilinguals who have very little presence of their heritage culture in their day to day lives. Then of course there is the multitude of individuals who likely find themselves somewhere in between these two worlds. Further, some may find themselves navigating between their heritage Latino culture and the mainstream American culture, developing degree of biculturalism, but not necessarily being bilingual. These individuals would be described as bicultural monolinguals. Despite their lack of linguistic cultural competence, they may still adhere to certain cultural values and practices coming from two cultures (Soffietti, 1960). Thus, it is not necessary to be simultaneously bilingual and bicultural. Despite not having two languages to balance, bicultural monolinguals still have two internal sets of values, traditions, and norms that they must maintain, relying on one set and inhibiting the other depending on the situation. As such, biculturalism, independent of bilingualism, may be a critical factor to consider within the cognitive reserve research.

Further, just as bilingualism is a complex construct that cannot truly be captured as a dichotomous variable, it can be argued that biculturalism also involves varying degrees of fluency. Balanced bilinguals are those who are equally proficient in two

languages (Colzato, et al., 2008); however, having a dominant language does not negate one's bilingualism, one is simply bilingual to a lesser degree. Verkuyten and Pouliasi, (2006) suggested examining level of biculturalism in research in order to differentiate between varying bicultural individuals. Thus, the argument can be made that one can vary in his or her level of biculturalism as is done with bilingualism. That is to say, an individual who is bicultural may be equally adept at navigating their two cultures and thus be a "balanced" bicultural. Others may be more skilled in one cultural context as compared to another with the ability to navigate the second cultural context being specific to certain settings or situations, but nonetheless bicultural to some degree.

Just as the use of two languages may improve executive functioning via the cultivation of more flexibility in thinking and processing, which may then ultimately be what leads to cognitive reserve, the behavioral and cognitive components of being guided by two sets of cultural values or norms via biculturalism, independent of bilingualism, may also lead to cognitive flexibility that ultimately is protective against neuropathology. There is in fact research to suggest unique neural processes in bicultural individuals. Interestingly, the relationship between biculturalism and neural activity has been found to be moderated by the psychological construct of bicultural identity integration, or BII (Huff, Yoon, Lee, Mandadi, & Gutchess, 2013), that can be thought of as the internal processes related to the outward behaviors expressed via biculturalism. BII refers to the extent with which bicultural individuals "perceive their mainstream and ethnic cultural identities as compatible and integrated vs. oppositional and difficult to integrate" (Benet-Martínez, Leu, Li, & Morris, 2002, p. 9). Among bilinguals, BII has been found to impact the frequency with which one uses both languages in his or her everyday life. Those who

are high in BII see their two cultures as being compatible and are able to integrate them, while those low in BII see their two cultures as oppositional and in conflict with one another (Benet-Martínez & Haritatos, 2005). The former group is more likely to use the languages of both cultures within daily life, while the latter is less likely to use and maintain both languages (Ramírez-Esparza & García-Sierra, 2014).

Whether an individual operates primarily within the framework of one culture versus the other is dependent on the context of the situation. This behavior is explained by the *two cultural minds theory* of biculturalism, which suggests that bicultural individuals possess two sets of cultural knowledge and schema that help guide their thoughts and behaviors (Cheng, Lee, Benet-Martínez, & Huynh, 2014). Activation of one cultural frame of reference depends on the cultural cues of a situation. The process of moving between cultures in response to cultural cues is known as *cultural frame switching*. Some research suggests that bicultural individuals are able to seamlessly transition between cultural frameworks and do so both in the presence of both explicit and implicit cultural cues (Pouliasi & Verkuyten, 2007, Devos, 2006). However, the ease with which one switches between cultures may depend on BII. Research suggests that when individuals see their cultures as distinct and disconnected, cultural frame switching becomes slowed and more difficult (Huff, et al., 2013). This indicates that there may be unique neural processes occurring among bicultural individuals. Thus, the impact of biculturalism on cognitive or other outcomes is likely influenced as much by the internal psychological components related to biculturalism (i.e., BII), as it is by the actual behaviors and ability to navigate two cultures (i.e., biculturalism) (Hong & Khei, 2014).

Cultural Neuroscience of Biculturalism. *Cultural neuroscience* has been defined as "a rhetorical and empirical approach to investigate and characterize the mechanisms by which this hypothesized bidirectional, mutual constitution of culture, brain, and genes occurs" (Chiao & Ambady, 2007, p. 238). Research in the emerging field of cultural neuroscience is based on the idea that our knowledge and experiences, which are socially constructed and thus greatly influenced by culture, have a significant impact on the neural pathways and organization of the brain (Chiao &Ambady, 2007). Biculturalism is a specific area of interest that has been explored, although within a limited scope, in the field of cultural neuroscience.

Within the cultural neuroscience research, biculturalism has been studied primarily among Asian-American individuals. Collectivistic (traditionally East Asian) and individualistic (traditionally Western) cultural schemas have been the basis for comparisons made among East Asians and Westerners. Among collectivists, an individual's identity is highly interconnected with that of his or her group and is viewed as an extension of the social systems of which they are a part, while individualists view their identities as independent and distinct from their social groups (Hofstede, 1980). Among bicultural individuals, it is thought to be the context of a situation that determines whether individuals think of themselves from an individualistic or collectivistic frame of reference (Chiao et al., 2010).

In an effort to explore bicultural representations of the self at the neural level, Chiao, et al. (2010) conducted a study with 30 self-identified bicultural Asian-Americans. Participants were primed with either collectivistic or individualistic values using previously validated priming tasks. Participants were then asked to complete a series of

self-judgment tasks while being scanned by an fMRI machine. The first task consisted of indicating whether or not a sentence described the participant in general. For the second task participants indicated whether or not a sentence described them within a specific context (e.g., does this sentence describe you when you are talking to your mother?). Finally, a control task was included in which participants provided responses to questions regarding the font of the text of the question. fMRI data revealed significant differences in the activation of the medial prefrontal cortex (MPFC) and posterior cingulate cortex (PCC) based on the cultural priming conditions. MPFC has been suggested as being involved in social cognitive processing (Amodio & Frith, 2006), while the PCC is thought to be related to emotional and memory related processes (Maddock, Garrett, & Buoncore, 2003). Both are believed to be essential in processing information relevant to one's self (Amodio & Frith, 2006, Northoff et al., 2006). Within the collectivistic values priming condition, participants demonstrated greater activation in the MPFC and PCC during contextual, relative to general, self-judgments. On the other hand, the individualistic value priming condition elicited greater activation in the MPFC and PCC during general, relative to contextual, self-judgments. The authors suggest that individualistic versus collectivistic priming temporarily directs individuals in their evaluation of general or contextual self-representations as more or less self-relevant. Furthermore, the findings are used to support the notion that it is cultural values, and not inherit differences between Westerners and Easterners that lead to differences in neural representations of the self (Chiao, et al, 2010). Thus, if among bicultural individuals, cultural context can determine how the self is represented at a neural level, cultural

context can likely lead to activation of different neural networks, perhaps resulting in outward interactions with the environment unique to the cultural context.

In a similar study of 48 Asian American participants, all of whom were born in an East Asian country and had lived there at least five years before moving to the U.S., BII was found to moderate the effects of cultural priming on neural activation (Huff, Yoon, Lee, Mandadi, & Gutchess, 2013). Participants were primed with either American or Asian primes and asked to judge a series of traits as being applicable to themselves, their mothers, or a familiar, but not personally known individual. They were later asked to remember the adjectives, while having their brains imaged. Individuals who were high in BII and primed with Asian cues were better able to recall adjectives ascribed to their mothers and showed greater MPFC activation at these times, as would be expected given prior research on priming and the self among Asian Americans. However, among individuals who were low in cultural harmony, or those who viewed their cultures as being in conflict, did not show this pattern of responding for the mother-relevant adjectives, but did so for the self-relevant adjectives. These findings again highlight the role of BII in biculturalism outcomes within a neuroscience framework.

The Current Study

The first aim of the current study was to examine the relationship between biculturalism and performance on measures of executive function and whether that relationship is moderated by education and cultural harmony, an aspect of BII, in a community based sample of older adult Latinos living in the Midwest. A second aim was to examine the relationship between bilingualism and measures of executive functioning, and explore the potential moderating effects of education.

By addressing the stated aims, the study will be the first to examine biculturalism as a predictor of executive functioning and present the idea of biculturalism serving as a potential contributor to cognitive reserve. In addition, the study will contribute to the existing literature on bilingualism and its potential cognitive benefits specific to U.S. older adult Latinos. Based on the available literature, it is hypothesized that:

1. Greater biculturalism will predict better executive function task performance.
2. The relationship between biculturalism and executive function will be moderated by years of education, such that greater biculturalism will predict better executive function more robustly among those with fewer years of education.
3. The relationship between biculturalism and executive functioning will be moderated by self-reported cultural harmony between the Latino and mainstream American cultures, such that among those who are higher in biculturalism, greater harmony will be related to better executive functioning.
4. Greater bilingualism will predict better executive function task performance.
5. The relationship between bilingualism and executive function will be moderated by years of education, such that greater degrees of bilingualism will predict better executive function more robustly among those with fewer years of education.

Methods

Participants

Participants were recruited from local community centers and other organizations known to serve or have a high representation of older Latino adults. A total of 32 individuals agreed to participate in the current study. All participants self-identified as Latino or Hispanic and were at least 60 years old. The age of 60 was chosen as a minimum age given that age-related cognitive change is thought to not be easily detected before then (Whalley, Deary, Appleton, & Starr, 2004). Of the 32 participants, seven were excluded from analyses due to either performing below the cut-off on cognitive screening, which may suggest the presence of neuropathology, or above the cut-off on a depression screen, as significant levels of depression have been found to be associated with executive dysfunction (Alexopoulos, et al., 2000). Among the 25 participants included in analyses, 15 (60%) identified as female and 10 (40%) as male. Participants ranged in age from 60-85 with a with a mean age of 67.71 (*SD=5.90).* About half (n=13, 52%) of the sample was born in the U.S. The majority of participants self-identified as bicultural based on a yes/no question (n=22, 88%), 3 (12%) indicated that they did not identify as bicultural, and the remaining 3 (12%) did not provide a response to the question. The most common educational attainment was less than high school (n=10, 40%), followed by an equal number of those with a bachelor's degree (n=4, 16%) or master's degree (n=4, 16%), then associate's or some college (n=3, 12%), high school (n=2, 8%), and doctoral/professional degree (n=1, 4%).

Procedures

All study procedures were approved by the Marquette University IRB. In addition to recruiting from community centers and organizations, flyers were placed at several locations throughout the community, although there were no responses to the flyers. Those who expressed interest in participating were first asked a series of yes/no questions prescreening questions, which asked about prior diagnoses of cognitive impairment, Alzheimer's disease or other dementias, serious mental illness, and substance abuse. All interested individuals responded "no" to all prescreening questions. Participants were then given an overview of the study procedures, risks, and benefits, given an opportunity to ask questions, and provided written consent. A depression screener and cognitive screen were then completed, followed by administration of self-report questionnaires and tests of executive functioning. All participants were entered for a chance to win a $50 cash prize. All materials were available in English and Spanish with participants having the option of completing measures in their preferred language. Those that indicated that they were bilingual were administered a naming test in both Spanish and English to assess bilingual proficiency. All procedures were carried out by a bilingual, bicultural doctoral candidate in clinical psychology.

Materials

Demographic and health questionnaire. Participants completed a demographic questionnaire that included information on age, marital status, sex, income, years of education, place of education, nativity status, family immigration history, cultural background, and self-reported identity as bilingual and bicultural.

Depression screen. The Patient Health Questionnaire- 9 (PHQ-9; Kroenke & Spitzer, 2002, see appendix A) is a nine-item self-report measure of depressive symptoms which correspond with DSM-IV criteria for depression. Responses are given using a 4-point Likert scale ranging from 0 (*not at all*) to 3 (*nearly everyday*). A total score is calculated with higher scores representing greater symptoms of depression. Scores ranging from 10-14 represent minor depressive symptoms, 15-19 indicate moderately severe symptoms, and scores 20 or greater indicate severe symptoms of major depression. The measure is available in several languages, including Spanish, and has been successfully used with older Latino adults (Chavez-Korell et al., 2012, Chavez-Korell, Benson-Flórez, Delgado Rendón, & Farías, 2013) with a Chronbach's alpha reported at .90. Chronbach's alpha in the current study was .81.

Cognitive Screen. The Montreal Cognitive Assessment (MoCA) is a brief cognitive screening tool that has been translated into several languages and is used in several countries as an indicator of cognitive functioning (Rossetti, Lacrtiz, Cullum, & Weiner, 2011). Broad domains assessed include executive functioning, visuospatial skills, memory, attention, language, verbal abstraction, and orientation. Points are earned for each task correctly completed with a maximum score of 30 and suggested cut-off score for normal versus impaired cognition of 26 (Nasreddine et al., 2005). One point is also added for those who have completed 12 or fewer years of education. The 26 cut-off score however has been questioned due to being too stringent, and lacking specificity (Malek-Ahmadi et al., 2015). For the current study, cut-off scores of 17, 18, and 22 were used for those with <12 years of education, 12 years of education, and greater than 12 years of education, respectively, based on normative data and recommendations obtained

from a U.S. population-based sample (Rossetti, et al., 2011). Those who scored below the cut-off for their respective level of education were not included in analyses as low scores may suggest the presence of neuropathology and would have confounded the results.

Biculturalism. The Cortes, Rogler, and Malgady Bicultural Scale (CRM-BS; Mezzich, Ruiperez, Yoon, Liu, & Zapta-Vega, 2009) is a 20-item self-report measure that assesses biculturalism based on mainstream American cultural behaviors and heritage cultural behaviors (see Appendix B). Respondents answer questions using a 4-point Likert scale ranging from 0 (*Not at all*) to 4 (*Very much*). Responses to the first 10 items are added to obtain a heritage culture score and the latter 10 items are added to obtain a mainstream American culture score. Individuals who score greater than 15 on each of the two subscales are considered to be bicultural. Of note, there are two language-based items included in each of the two subscales. These include asking participants to rate how comfortable they would be in a group who does not speak English/Spanish and how much they enjoy speaking Spanish/English. While these are language based they do not address proficiency. Thus, they are independent of the bilingualism measures being addressed in the present study. Additionally, even if the previously mentioned items were all endorsed to the highest degree (i.e., threes) being deemed as bicultural would have to include additional components of biculturalism that do not include language. Among an adult sample of Latinos ranging in age from 19-84, Chronbach's alphas were reported at 0.94 for items 1-10, .90 for items 11-20, and .70 for the total measure. Test-retest reliability Pearson correlation coefficients were reported at 0.93, 0.88, and 0.85 for items 1-10, 11-20, and the total scale. For the current study Chronbach's alphas were .84 and

.88 for the Latino heritage cultural orientation and mainstream American orientations, respectively. For the current study, in addition to categorizing participants as bicultural, mainstream monoculture, or traditional monoculture, index scores representing degree of biculturalism were calculated by dividing individual mainstream American orientation score totals by Latino heritage cultural orientation totals, resulting in scores ranging from 0-100%, based on the method used for assessing degree of bilingualism (Gollan, 2013).

Bilingual ability. In addition to a single yes/no question regarding bilingualism, the Multilingual Naming Test (MINT; Gollan, 2013), a 68-item picture naming task, was administered to those who indicated that they were bilingual. It was developed with the intention of including items that are similar in their familiarity and frequency of use across English, Spanish, Hebrew, and Mandarin speakers. Previous studies have administered this measure in both English and Spanish to derive a bilingual ability score ranging from 0-100%, as was done in the present study. The MINT has also been found to be significantly correlated with oral proficiency interviews conducted in English and Spanish (Gollan, Weissberger, Rupnqvist, Montoya, & Cera, 2012).

Cultural Harmony. The Bicultural Identity Integration Scale – Version 2R (BIIS-2R; Huynh & Benet-Martínez, 2010) is a 20 item self-report measure that assesses how in harmony versus in conflict, and how blended versus compartmentalized one perceives their cultures to be. Responses are given using a Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Harmony and Blendedness subscale scores are treated independently and a total scale score is not calculated. Scores are derived by obtaining the mean of items that make up the subscale. For the current study only the Harmony subscale items were administered. The measure is available for use in several

languages, including English and Spanish. In a multiethnic sample of 1,049 bicultural individuals, Chronbach's alpha coefficients were reported at .86 for the cultural harmony scale and .81 for the cultural blendedness scale (Huynh & Benet-Martínez, 2010). Chronbach's alpha for the harmony scale used in the current study was .86.

Executive Functioning. Various components of executive function were assessed using the Trail Making Tests A & B (TMT; Reitan & Wolfson, 1985), a phonemic fluency task, and the Executive Clock Drawing Test (CLOX; Royall, Cordes, & Polk, 1998).

The Trail Making Test, parts A and B (Reitan & Wolfson, 1985) are timed sequencing tasks. Part A consists of connecting numbers 1-25 in order as quickly as one can within a 131" time limit. In addition to the speeded sequencing and motor component of Part A, Part B requires an inhibition and switching component, whereby the individual is asked to connect numbers and letters in order switching between numbers and letters as they go along. In each condition the examiner identifies any mistakes, which are then corrected by the participant. Raw scores are based on number of seconds to complete the task. Good construct validity has been shown in both English and Spanish versions of this task (Cherner et al., 2008). Longitudinally, TMT B performance has been found to accurately discriminate between individuals who would go on to develop AD after 1.5 years (Chen, Ratcliff, Belle, Cauley, DeKosky, & Ganguli, 2000). As it is Part B that taps executive function via the inhibition and switching components of the task, and both tasks require speed and motor abilities, a TMT B/A performance ratio has been suggested as the best measure of executive function, as opposed to TMT B performance alone (Arbuthnnott, 2000). Thus, for the current study the TMT B/A ratio was used.

The Controlled Oral Word Association Test (COWAT) (Benton, 1967) is a verbal fluency task in which participants are asked to produce as many words that they can think of that start with a given letter of the alphabet within one minute. Proper nouns, the same word with different endings, and repeated words are not given credit. Raw scores are equal to the number of acceptable words produced within the allotted minute. Consistent with prior studies and clinical practice, the letters F-A-S were used for English administration and P-M-R for Spanish administration (Artiola i Fortuny, Hermosillo, Heaton, & Pardee, 1999; Suarez, Gollan, Heaton, Grant, Cherner, & HNRC Group, 2014). Performance on similar phonemic fluency tasks has been found to be predicted by greater estimated cognitive reserve (Roldán-Tapia, García, Cánovas, & León, 2012).

The CLOX is a two-part clock drawing task in which participants are first given the instruction "Draw a clock that says 1:45. Set the hands and numbers on the face so that a child could read them.", (CLOX1). It requires initiation, planning, and sequencing. The second part of the task (CLOX2) requires participants to copy a clock drawn by the examiner. The two parts allow for differentiation between executive dysfunction and motor or visuospatial problems (Royall et al., 1998). Performance on CLOX1, but not CLOX2 has been found to predict the number of categories completed on the Wisconsin Card Sorting Task, a commonly used measure of executive functioning (Royall, Chiodo, & Polk, 1997). Raw scores range from 0-15 on each part of the task with 0 or 1 point awarded for each of 15 quantifiers. The CLOX has been validated with a Spanish speaking sample with Chronbach's alphas for the English and Spanish CLOX1 and CLOX2 ranging from 0.82-0.83. Of note, acculturation had a modest effect on CLOX1

performance, such that those who were less acculturated performed worse on the task, although this was mediated by education (Royall et al., 2000).

Results

All data were analyzed using SPSS 23.0 (IBM Corp, 2014). Data were first screened for normality. In cases of missing data, pairwise deletion was used for analyses. An outlier was found in Trails B time to complete (2.69 *SD* from mean) and was removed from the dataset. In addition, Trails B time to complete was positively skewed (2.11) and thus was transformed using a square root transformation, although TMT B/A ratios were used in main study analyses and are based on original values.

Mean scores for each of the executive functioning tasks were calculated for the overall sample, as well as by age and educational attainment. In addition, mean scores by language of administration for the phonemic fluency task were calculated. TMT and CLOX scores are presented in Table 1. Phonemic fluency scores are presented in Table 2. Performance on TMT A & B for the current sample was commensurate (within one *SD*) with previously reported data based on demographically similar samples of Hispanic older adults consisting of primarily Spanish-speaking individuals (Acevedo, Loewenstein, Agrón, & Duara, 2007; Benson, de Felipe, Xiaodong, & Sano,2014) as well as Spanish/English bilinguals and monolinguals (Weissberger, Salmon, Bondi, & Gollan, 2013). In an English-speaking normative sample (race/ethnicity not reported) when examining scores based on age and education, TMT A performance was slightly below previously reported scores for the age 60-69, age 70-79, and education <12 cohorts, with calculated z-scores of -1.46, -1.16, and -1.43, respectively (Tombaugh, 2004).

Table 1

Means and (Standard Deviations) of Demographics, Trail Making Tests and CLOX Performance by Age and Education

		Age		Education	
	Overall Sample	60-69	70-79	<12	≥12
Variable	M *(SD)*	M *(SD)*	M *(SD)*	M *(SD)*	M *(SD)*
1. Age	67.71(5.90) (n=21)	64.29 (2.02) (n=14)	72.83 (2.14) (n=6)	71.25 (7.07) (n=8)	65.58 (4.10) (n=12)
2. Education	12.46 (5.49) (n=24)	14.31 (4.13) (n=13)	8.50 (5.54) (n=6)	6.22 (2.39) (n=9)	16.20 (2.48) (n=15)
3. Trails A Time	45.84 (20.93) (n=25)	41.50 (17.60) (n=14)	60.17 (26.84) (n=26.84)	64.11 (17.55) (n=9)	32.60 (9.44) (n=15)
4. Trails B Time	94.19 (39.38) (n=21)	83.85 (30.87) (n=13)	113.33 (41.19) (n=3)	127.83 (41.54) (n=6)	80.73 (30.32) (n=15)
5. CLOX I	12.84 (1.03) (n=25)	12.93 (.92) (n=14)	12.17 (1.33) (n=6)	12.56 (1.24) (n=9)	13.07 (.884) (n=15)
6. CLOX II	13.28 (.74) (n=25)	13.43 (.65) (n=14)	12.67 (.82) (n=6)	13.11 (.93) (n=9)	13.33 (.62) (n=15)

Table 2

Means and (Standard Deviations) of Demographics and Phonemic Fluency Performance by Language, Age, and Education

		Language		Age		Education	
	Overall Sample	English (FAS)	Spanish (PMR)	60-69	70-79	<12	≥12
Variable	M *(SD)*	M *(SD)*	M *(SD)*	M *(SD)*	M *(SD)*	M *(SD)*	M *(SD)*
1. Age	67.71(5.90) (n=21)	64.50 (2.51) (n=12)	72.00 (6.50) (n=9)	64.29 (2.02) (n=14)	72.83 (2.14) (n=6)	71.25 (7.07) (n=8)	65.58 (4.10) (n=12)
2. Education	12.46 (5.49) (n=24)	15.54 (2.93) (n=13)	8.82 (5.65) (n=11)	14.31 (4.13) (n=13)	8.50 (5.54) (n=6)	6.22 (2.39) (n=9)	16.20 (2.48) (n=15)
3. Phonemic Fluency Total	32.52 (10.49) (n=25)	37.54 (6.98) (n=13)	27.08 (11.16) (n=12)	35.71 (6.70) (n=9)	32.60 (9.44) (n=15)	25.33 (11.62) (n=9)	37.47 (6.74) (n=15)

Performance on TMT B was commensurate with the Tombaugh (2004) sample with the exception of the ≥12 education cohort, which was slightly below expectation (z=-1.46).

Phonemic fluency performance of the current sample was commensurate with previously reported data from bilingual Hispanic samples (Gollan, Fennema-Notestine, Montoya, & Jernigan, 2006; Rosselli et. al., 2000), as well as primarily Spanish-speaking samples (Acevedo et. al., 2007, Artiola i Fortuny, Heaton, & Hermosillo, 1998), mixed Spanish/English bilingual and monolinguals (Weissberger et. al., 2013), and English-speaking age and education matched samples (race/ethnicity not reported) (Tombaugh, Kozak, & Rees, 1999).

CLOX 1 and 2 norms were within expectation based on previously reported data for Hispanic individuals from a multiethnic sample of older adults (Menon, Hall, Hobson, Johnson, & O'Bryant, 2012) as well as that of a Mexican-American sample used in the validation of the Spanish version of the CLOX (Royall et. al., 2003). Of note, Menon et. al. (2012) reported that their data did not support a need for stratification by education and gender among the Hispanic participants in the sample. While data were stratified by age, the age groups were 40-51 and 52+, thus all participants in the current sample would be represented by the latter cohort with current sample performance being commensurate with that of the 52+ group.

Initial correlations revealed a significant positive correlation between phonemic fluency and education and a negative correlation between phonemic fluency scores and age. In addition, age and education were significantly and negatively correlated. Means, standard deviations, and correlations of main study variables are presented in Table 3.

Table 3

Means (Standard Deviations) and Correlations among Main Study Variables

Variable	n	M *(SD)*	2	3	4	5	6	7	8
1. Biculturalism	25	69.88 (19.43)	.33	.10	.24	-.16	-.39	-.07	.17
2. Bilingualism	16	72.19 (18.79)	-	-.25	.41	.42	.31	-.22	.43
3. Cultural harmony	25	3.62 (.78)	-	-	.33	-.02	-.17	.19	.13
4. Education	24	12.46 (5.49)	-	-	-	-.62**	.08	.58**	-.02
5. Age	21	67.71 (5.90)	-	-	-	-	.20	-.46*	.10
6. Trails B/A ratio	20	2.37 (.72)	-	-	-	-	-	.02	-.28
7. Phonemic fluency	25	32.52 (10.49)	-	-	-	-	-	-	.18
8. CLOX ratio	25	.97 (.08)	-	-	-	-	-	-	-

Note. * $p < .05$, ** $p < .01$

Overall participants were high in biculturalism and cultural harmony. Among those who were bilingual, they scored high in degree of bilingualism. Cultural variables were not correlated with one another, nor was performance across tasks of executive functioning.

To test hypothesis one, which stated that greater biculturalism would predict better performance across tasks of executive functioning a series of hierarchical multiple regressions were conducted with TMT B/A ratio, phonemic fluency performance, and CLOX each serving as dependent variables in separate regressions with age and years of education entered in step one and biculturalism in step two for each of the three regressions. The overall model for biculturalism predicting the TMT B/A ratio was not significant. In the first step of the model age and education contributed to 10% of the variance in TMT B/A ratios, F (2,13) = .74, p = .50. In step two the biculturalism index score accounted for an additional 17% of the variance and the overall model was not significant F (3,12) = 1.51, p = .26.

While the overall model for age, education, and biculturalism predicting phonemic fluency was significant, education was the only significant predictor of phonemic fluency. In step one age and education contributed to 35% of the variance in phonemic fluency scores, F (2,17) = 4.56, p = .03. In step two, biculturalism accounted for an additional 4.7% of the variance, F change (1,16) = 1.26 p= .28 and was not significant, however the model as a whole was significant, F (3,16) = 3.51, p = .04. Education was a significant predictor of phonemic fluency such that greater years of education was related to better performance on the phonemic fluency task (β = .53, p = .05).

The model for biculturalism predicting CLOX ratios was not significant. In step one age and education accounted for 1.3% of the variance, F (2,17) = .11, p = .90 with an additional 3.1% accounted for in step two with the addition of biculturalism which as a whole was not significant, F (3, 16) = .25, p = .86. Thus, hypothesis one was not supported, after accounting for age and years of education, biculturalism was not found to predict TMT B/A ratios, phonemic fluency performance, or CLOX ratios.

To test hypothesis two, that the relationship between biculturalism and executive functioning would be moderated by years of education, such that biculturalism would predict better executive function more robustly among those with fewer years of education a series of hierarchical multiple regressions were conducted with biculturalism and years of education entered at step one and the interaction of biculturalism and education entered at step two in three separate regressions, each predicting TMT B/A ratios, phonemic fluency scores, and CLOX ratio scores. Predictor variables were centered to avoid violating assumptions of multicollinearity. In the first regression, education and biculturalism were entered at step one, accounting for 18% of the variance in TBT B/A ratios, F (2,17) = 1.87, p = .18. The interaction between education and biculturalism was entered at step two, accounting for an additional 3.7% of the variance, which was not statistically significant, F change (1,16) = .76, p = .395. Of note, while the overall model F (3, 16) = 1.49, p = .25 was not significant, biculturalism nearly reached statistical significance as a unique predictor of TMT B/A ratios, (β = -.51, p = .05).

In the next regression education and biculturalism were again entered in step one, accounting for 38% of the variance in phonemic fluency scores, F (2, 21), p < .02. The interaction of the education and biculturalism was entered at step two, accounting for an

additional .02% of the variance, F change (1,20) = .06, p = .81 with the model as a whole reaching significance, F (3,20) = 4.09, p = .02 due to the contribution of education (β = .65, p = .00).

In the final regression education and biculturalism were again entered in step one, accounting for 3.1% of the variance in CLOX ratio scores, F (2, 21) = .33, p = .72. In step two, the interaction between education and biculturalism contributed to an additional 15.6% of the variance, F change (1,20) = 3.82, p = .065, and was not significant, nor was the overall model significant, F (3,20) = 1.53, p = .24. Thus, hypothesis two was not supported. Years of education was not found to moderate the relationship between biculturalism and executive functioning tasks.

To test hypothesis three, which stated that the relationship between biculturalism and executive functioning would be moderated by self-reported harmony between the Latino and mainstream American cultures, such that greater biculturalism would predict executive functioning more robustly among those those higher in cultural harmony, three separate hierarchical multiple regressions were conducted with biculturalism and cultural harmony entered in step one and the interaction of the two at step two predicting each of the three indicators of executive functioning: TMT B/A ratio, phonemic fluency scores, and CLOX ratio scores. In the first regression biculturalism and cultural harmony accounted for 16.8% of the variance in TMT B/A ratio scores, F (2,17) = 1.71, p = .209. In step two the interaction of biculturalism and cultural harmony accounted for an additional 10.1% of the variance, F change (1,16) = 2.21, p = .16, overall model F (3,16) = 1.96, p = .16, and thus was not statistically significant.

In the next regression, biculturalism and cultural harmony in step one accounted for 4.3% of the variance in phonemic fluency scores, F (2,22) = .49, p = .62. The interaction of biculturalism and cultural harmony accounted for an additional .09% of the variance, F change (1,21), p = .66, and was not significant, overall model F (3,21) = .38, p = .77.

In the third regression biculturalism and cultural harmony entered simultaneously at step one accounted for 4.1% of the variance in CLOX ratios, F (2,22) = .47, p = .63. The interaction of the biculturalism and cultural harmony accounted for an additional 1.7% of the variance, F change (1,21) = .37, p = .55, and was not significant, nor was the overall model significant, F (3,21) = .43, p = .74. Therefore, the data did not support hypothesis three, that cultural harmony would serve as a moderator between biculturalism and performance on measures of executive functioning.

To test hypothesis four, that greater degrees of bilingualism would predict better performance on tasks of executive functioning, a series of hierarchical multiple regressions were conducted with TMT B/A ratios, phonemic fluency, and CLOX ratios each serving as dependent variables in separate regressions with age and years of education entered in step one and bilingualism in step two for each regression. In step one of the first regression, age and education accounted for 10.2% of the variance in TMT B/A ratio scores, F (2,10) = .57, p = .58. In step two bilingualism accounted for an additional 17% of the variance, F change (1,9) = .59, p = .46 and was not significant. The overall model was also not significant, F (3,9) = .56, p = .66.

In a second regression age and education were again entered in step one and accounted for 35% of the variance in phonemic fluency scores, F (2,10) = 2.68, p = .12.

In step two, of bilingualism accounted for an additional 4.7% of the variance, *F* change (1,9) = .04, *p*=.86, which was not significant, nor was the overall model significant, *F* (3,9) = 1.63, *p* = .25.

In a final regression age and education entered in step one accounted for 1.3% of the variance in CLOX ratio scores, *F* (2,10) = .07, *p* = .94, with an additional 3.1% of the variance accounted for in step two with the addition of bilingualism, *F* change (1,9) = .67, *p* = .44, and was not significant. The overall model was also not significant, *F* (3,9) = .26, *p* = .85. Thus, hypothesis four, which stated that bilingualism would predict performance on executive functioning tasks, was not supported.

Finally, to test hypothesis five, that the relationship between bilingualism and executive functioning would be moderated by years of education, such that greater degrees of bilingualism would predict better executive functioning more robustly among those with fewer years of education, a series of multiple regressions were again conducted with bilingualism and years of education entered at step one and the interaction of biculturalism and education at step two in a three separate regressions with TMT B/A ratios, phonemic fluency scores, and CLOX ratio scores serving as dependent variables in each of the three regressions. All predictor variables were centered to avoid violating assumptions of multicollinearity. Degree of bilingualism and education were entered in step one of the first regression, accounting for 10.2% of the variance in TMT B/A ratios, *F* (2,10) = .66, *p* = .54. The interaction between bilingualism and education was entered at step two, accounting for an additional 5.5% of the variance, *F* change (1,9) = .74, *p* = .74, and thus not statistically significant. The overall model was also not significant, *F* (3,9) = .44, *p* = .73.

In the next regression, bilingualism and education were entered in step one, accounting for 34% of the variance in phonemic fluency scores, F (2, 12), p = .08 The interaction of the two variables was entered at step two, accounting for an additional .03% of the variance, F change (1,11) = .69, p = .42 and thus was not significant, nor was the overall model significant, F (3, 11) = 2.25, p = .14.

In the final regression, bilingualism and education were again entered in step one, accounting for 4.1% of the variance in CLOX ratio scores, F (2, 12) = .26, p = .78. In step two the interaction between bilingualism and education contributed an additional 9.5 % of the variance, F change (1,11) = 1.22, p = .29, and thus was not significant, nor was the overall model significant, F (3, 11) = .58, p = .64. Therefore, hypothesis five, which stated that the relationship between and performance on tasks executive functioning would be moderated by years of education, was not supported.

After examining study hypotheses across all participants, additional exploratory analyses were conducted. As the educational experience between U.S. and non U.S. educated individuals likely varies significantly (Manly & Mayuex, 2004) possible group differences in age, education, biculturalism, cultural harmony, and executive functioning measures, based on place of education were explored. In addition, given documented sex differences in cognitive test performance (Upadhayay & Guragain, 2014), differences in main study variables by sex were examined. Significant differences were identified in phonemic fluency performance between U.S. (n=14) versus non U.S. (n=10) educated individuals as well as women (n=15) and men (n=10). Non U.S. educated individuals, as well as women, were found to be significantly older and have fewer years of education as compared to their U.S. educated and male counterparts, respectively. See Table 4.

Table 4

Independent Samples T-test Results for Main Study Variables by Place of Education and Sex

	Placed of Education		Sex	
Variable	U.S.	Non U.S.	Female	Male
Biculturalism	73.86 (15.79)	61.60 (21.54)	66.27 (19.79)	75.30 (18.53)
Bilingualism	67.00 (18.39)	84.33 (8.51)	70.50 (23.98)	73.88 (13.23)
Cultural harmony	3.84 (.73)	3.32 (.84)	3.71 (.83)	3.48 (.74)
Education	15.86 (3.06)	7.70 (4.50)**	9.71 (5.51)	16.30 (2.21)**
Age	64.00 (1.90)	72.56 (6.02)**	69.46 (6.64)	64.88 (3.00)*
TMT B/A ratio	2.28 (.71)	2.57 (.75)	2.29 (.69)	2.46 (.78)
Phonemic fluency	37.07 (7.01)	27.10 (12.13)*	29.13 (11.49)	37.60 (6.33)*
CLOX ratio	.98 (.08)	.97 (.08)	.96 (.08)	.99 (.08)

Note. *, $p < .05$ ** $p < .005$

Given these findings, analyses conducted as part of initial study hypotheses involving biculturalism and phonemic phonemic fluency task scores were conducted separately for U.S. educated versus non U.S. educated individuals, as well as women versus men. Additional analyses examining bilingualism could not be conducted due to insufficient sample size.

Analyses were first conducted separately for U.S. and non U.S. educated participants. Among U.S. educated individuals, a hierarchical multiple regression examining biculturalism, age, education, and phonemic fluency performance, revealed that age and education entered in step one contributed to 51% of the variance in phonemic fluency scores, F (2,8) = .51, p = .62. In step two, the addition of biculturalism accounted for an additional 5.7% of the variance, F change (1,7) = .48, p=.51, but was not significant, nor was the overall model significant, F (3,7) = .48, p = .71. Among non U.S. educated individuals when education and age were entered in a step one of a hierarchical multiple regression predicting phonemic fluency scores, the model accounted for 49% of the variance, F (2,6) = 2.93, p = .13. In step two, with the addition of biculturalism the model accounted for an additional 35% of the variance, F change (1,5) = 11.06, p = .021, overall model F (3,5) = 8.91, p = .02 with education being the most significant predictor of phonemic fluency performance, β = .93, p = .01, followed by biculturalism, β = -.66, p = .02. This suggests that as expected, more years of education was predictive of better phonemic fluency performance. On the other hand, greater biculturalism was predictive of poorer performance on a phonemic fluency task among the non U.S. educated individuals, in contrast to the stated hypothesis. Post-hoc power analyses were conducted using G*Power 3.1 (Faul, Erdfelder, Buchner, & Lang,

2009) based on α=.05 and the observed f^2 effect size = 5.33, revealing an obtained power of .98, suggesting sufficient power, despite limited sample size (n=9).

To examine the potential moderating effect of education in the relationship between biculturalism and phonemic fluency performance among U.S. educated participants, biculturalism and education were entered in step one, accounting for 4.1% of the variance in phonemic fluency scores, F (2, 11) = .24, p =.80. The interaction of biculturalism and education was entered at step two, accounting for an additional 22% of the variance, F change (1,10) = 2.97, p = .12 and was not significant, nor was the overall model significant, F (3, 10) = 1.18, p = .37. Among non U.S. educated individuals, biculturalism and education were again entered in step one, accounting for 82% of the variance in phonemic fluency scores, F (2, 7) = 16.11, p =.00. The interaction of the education and biculturalism was entered at step two, accounting for an additional 0.6% of the variance, F change (1,6) = .23, p = .65 and was not significant, however the overall model reached statistical significance, F (3, 6) = 9.63, p = .01 with education being a significant predictor of phonemic fluency performance such that greater years of education was related to better phonemic fluency task performance (β = .95, p = .01).

Next, the the potential moderating effect of cultural harmony in the relationship between biculturalism and phonemic fluency scores was examined among U.S. educated individuals. Biculturalism and cultural harmony were entered in step one of a hierarchical multiple regression, accounting for 31% of the variance in phonemic fluency scores, F (2, 11) = .31, p =.74. The interaction of biculturalism and cultural harmony was entered at step two, accounting for an additional 0.5% of the variance, F change (1,10) = .05, p = .83 and was not significant, nor was the overall model significant, F (3,10) = .20, p =.89.

Among non U.S. educated participants biculturalism and cultural harmony entered at step one accounted for 22% of the variance in phonemic fluency scores, F (2,7) = .97, p = .43. The interaction of the two variables entered at step two accounted for an additional 7.1% of the variance, F change (1,6) = .60, p = .47, overall model F (3,6) = .81, p =.53, and was not significant.

Analyses examining the relationship between biculturalism and phonemic fluency scores were then conducted separately for women and men. Among women, when age and education were entered in a step one of a hierarchical multiple regression predicting phonemic fluency scores, the model accounted for 29.1% of the variance, F (2,9) = 1.85, p = .21. In step two, with the addition of biculturalism the model accounted for an additional 12% of the variance, F change (1,8) = 1.63, p = .24, overall model F (3,8) = 1.86, p = .21, and was not significant. A second regression conducted with male participants revealed that age and education entered in step one contributed to 8.3% of the variance in phonemic fluency scores, F (2,5) = .23, p = .81. The addition of biculturalism in step two contributed to an additional 5.5% of the variance, F change (1,4) = .06, p = .83, and was not significant, nor was the overall model significant, F (3,4) = .14, p = .93. Thus, for neither women nor men, the biculturalism did not predict phonemic fluency performance.

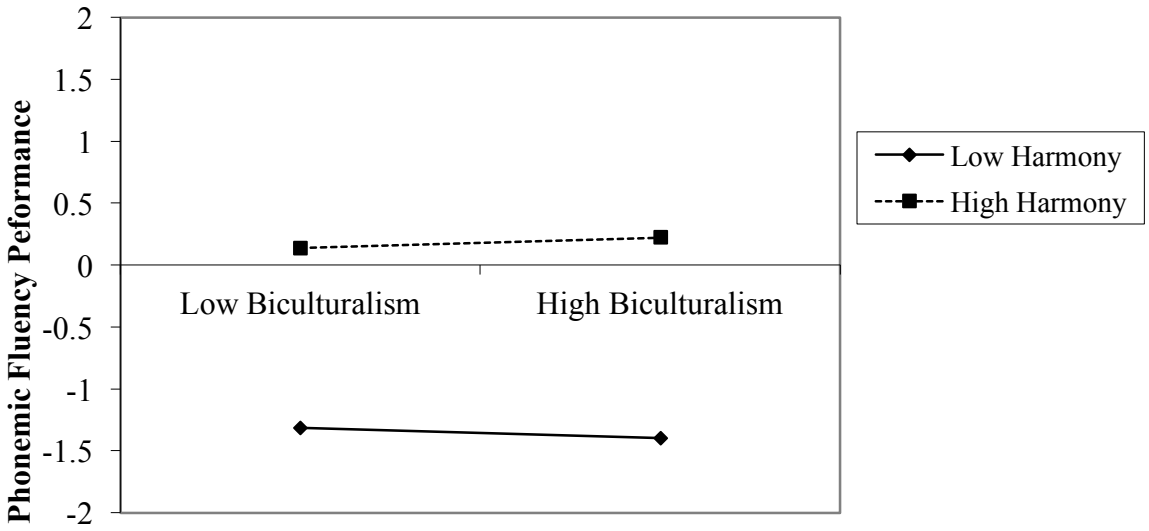
Next, hierarchical multiple regressions examining the potential moderating effect of education on the relationship between biculturalism and phonemic fluency were conducted separately for women and men. Among women, biculturalism and education entered in step one accounted for 39.9% of the variance in phonemic fluency scores, F (2,11) = 3.65, p = .06. In step two the interaction of degree and biculturalism and

education was entered and accounted for an additional 2.9% of the variance, *F* change (1,10) = .51, *p* =.49, overall model *F* (3,10) = 2.50, *p* = .12. and was not significant. For men, biculturalism and education were entered in step one and accounted for 1.3% of the variance in phonemic fluency performance, *F* (2,7) = .05, *p* = .95. In step two the interaction of biculturalism and education accounted for an additional 10.1% of the variance, but was not significant, *F* change (1,6) = .67, *p* = .44, nor was the overall model significant, *F* (3,6) = .26, *p* = .85. Thus, years of education was not found to moderate the relationship between biculturalism and phonemic fluency performance for either women or men.

Next, hierarchical multiple regressions examining the potential moderating effect of cultural harmony in the relationship between biculturalism and phonemic fluency were conducted independently for women and men. Among women, biculturalism and cultural harmony entered in step one accounted for 36.9% of the variance in phonemic fluency scores, *F* (2,12) = 3.5, *p* = .06. The addition of the interaction of the two variables in step two accounted for an additional 20.4% of the variance, *F* change (1,11) = 5.24, *p* = .04, overall model *F* (3,11) = 4.9, *p* = .02, reaching statistical significance. Cultural harmony was the most significant predictor, β = .70, *p* = .01, followed by the interaction of biculturalism and cultural harmony, β = .65, *p* = .04. These findings suggest that women who endorsed higher biculturalism, in conjunction with higher levels of cultural harmony performed better on a phonemic fluency task. See Figure 1. Post-hoc power analyses were conducted using G*Power 3.1 (Faul, et. al. 2009) based on α=.05 and observed f^2 effect size = 1.34, revealing an obtained power of .89, suggesting adequate power, despite limited sample size (n=15).

Figure 1

Moderator Effect of Cultural Harmony in the Relationship between Biculturalism and Phonemic Fluency Performance among Women (n= 15)



Among men, biculturalism and cultural harmony accounted for 6% of the variance, F (2,7) = .23, p = .80. In step two the interaction of biculturalism and cultural harmony accounted for an additional .7% of the variance, F change (1,6) = .05, p = .84, overall model F (3,6) = .15, p = .93, and was not significant.

Discussion

The current study was an exploratory investigation of biculturalism and bilingualism as predictors of executive functioning among older adult Latinos living in the U.S., and the potential moderating effects of education and cultural harmony. Preliminary analyses revealed that performance on tasks of executive functioning was grossly commensurate with previously published data from groups with similar demographic characteristics. In addition, correlational analyses revealed significant correlations only between education and age, education and phonemic fluency performance, and age and phonemic fluency performance. The lack of statistically significant correlations between the executive functioning outcomes, as well as that of the cultural factors are important to consider. First, with regard to tasks of executive functioning, these data highlight the broad scope of cognitive processes included within the construct of executive functioning. Therefore, independently examining the subdomains of executive functioning, including behavioral inhibition, planning, reasoning, and cognitive flexibility (Duff, Schoenberg, Scott, & Adams, 2005; Miyake et al., 2000) within the culture and cognition research may be important to consider as different cultural processes (e.g., bilingualism and biculturalism) may perhaps impact these subdomains in unique ways. Second, while bilingualism and biculturalism are often discussed together with one thought to necessitate the other (Grosjean, 2015), the current

data suggest that they are truly independent constructs. Thus, it is important to treat them as such in the research and go beyond language when examining biculturalism. That is to say, considering factors such as how often one engages in particular cultural events or traditions, the extent to which one might interact with monocultural individuals from each culture, and how values from each culture influence one's daily lives would provide a fuller and more accurate conceptualization of biculturalism. Further, the lack of relationship between cultural harmony and biculturalism suggests that cultural harmony is also an important and independent cultural factor that is not based on one's level of biculturalism.

With regard to main study hypotheses, hypothesis one, which stated that greater biculturalism would predict performance on executive functioning tasks was not supported. Biculturalism was not found to predict either TMT B/ A or CLOX ratios. However, when examining only participants who were educated outside of the U.S., greater biculturalism was predictive of poorer performance on a phonemic fluency task, contrary to the stated hypothesis. This was an unexpected result and may be due in part to the bicultural development process among those who were educated outside of the U.S, all of whom were also non U.S. born. Adapting mainstream American values and behaviors may have been forced upon them by a new environment or they may have felt pressured to develop a bicultural identity in order to better navigate a new setting. For example, in a qualitative investigation of bicultural development a participant was quoted as saying, "You can't really live one life because if you do, then people look at you strangely for whichever one you're not living…I do it to stay out of trouble" (Bacallao & Smokowski, 2009). The sentiment expressed here is that of biculturalism being the result

of necessity and pressure. This can be explained by the idea of acculturative stress, or the psychological burden that can result from navigating more than one culture (Berry, Kim, Minde, & Mok, 1987). Thus, given the potential affective burden of the process of becoming bicultural and the cumulative stress associated with the process, the potential benefits of being bicultural may have been mitigated among the non U.S. educated/non U.S. born participants. It is perhaps an affective component or cultural struggle that was not captured in the current study that may explain why being higher in biculturalism was related to worse phonemic fluency outcomes for this group of individuals.

Hypothesis two, which stated that the relationship between biculturalism and executive functioning would be moderated by years of education, such that greater biculturalism would predict better executive functioning more robustly among those with fewer years of education was not supported in either the overall sample or when examining U.S. as compared to non U.S. educated individuals, or women to men, despite greater education being related to increased performance on the phonemic fluency task. There is perhaps a need to examine the interaction of biculturalism and education at a more nuanced level, taking into account frequency of cultural frame switching, age of acquisition of the second culture, as well as educational quality.

Hypothesis three, which stated that the relationship between biculturalism and executive functioning would be moderated by self-reported harmony between the Latino and mainstream American cultures, such that biculturalism would predict executive functioning task performance more robustly among those who are higher in cultural harmony was partially supported. Among women, higher biculturalism when combined with high cultural harmony, was predictive of better performance on a phonemic fluency

task. This suggests that biculturalism does have the potential to positively contribute to some aspects of executive functioning, and thus cognitive reserve, at least in some cases. Further, the findings suggest that when examining biculturalism, it is necessary to not only examine the practice of bicultural behaviors, but also the internal processes, such as cultural harmony, that are related to navigating two cultural systems. The difference in findings for women as compared to men may be reflective of gender-norms within Latino culture. Particularly strong delineations of gender roles within Latino families are not uncommon. The feminine role traditionally involves limited independence as compared to male counterparts, and an emphasis on maintaining strong familial relationships (Raffaelli & Ontai, 2004). When integrating and navigating a culture such as that of the mainstream U.S. that contrasts with the gender norms of a Latina's traditional heritage culture, more starkly than it might for Latino males, the potential for biculturalism to impact cognitive outcomes may be particularly vulnerable to how the individual integrates the two cultures.

Hypotheses four and five, which stated that higher bilingualism would predict better executive functioning task performance and that that relationship would be moderated by education, were not supported. While bilingual proficiency was measured, frequency of use of each language was not assessed and is important to consider in future studies, as is age of acquisition of the languages. Perhaps simply reaching proficiency in two languages is not enough to improve executive functioning and cognitive reserve, but the maintenance of the languages via practiced use of both languages is necessary. Alternatively, the limited sample size and reduced power may also explain null findings.

Interestingly, while women typically perform better on verbal fluency tasks than men (Upadhayay & Guragain, 2014), men outperformed women in the current study. This is likely due to higher educational achievement and younger age of the men as compared to women in the sample.

Limitations

A major limitation of the current study was the limited sample size, thus restricting power and ability to conduct other analyses. Despite the researcher's attempts to engage with community organizations and their members and reassure potential participants about their concerns, at least one organization leader as well as multiple potential participants were reluctant to engage in the study. It is noteworthy that several participants mentioned concern over their ability to be helpful and provide "correct" responses. In addition, due to the cognitive testing component of the study, one participant shared that other individuals at the senior center where she was recruited from were concerned that by participating in the study they would be given a diagnosis and then referred to the adult day care at the center. The researcher and staff at the center made several attempts to clarify that this was not the case, but were unsuccessful in getting a significant number of additional individuals to participate. The struggles associated with recruiting Latino individuals in research is well-documented (George, Duran, & Norris, 2014) and the aforementioned examples from the current study highlight these barriers. Continuing to find ways to engage Latinos in research is critical for better understanding and serving the community.

The generalizability of the current findings is also a limitation. Participants either attended a senior center or were somehow socially connected to others and then referred

to the study. As increased participation in leisure and social activities has been identified as a contributor to cognitive reserve (Stern, 2009), current results may not be representative of older adults who are less social or less involved with their communities. Future studies may want to examine and control for level of leisure and social activity. Due to limited resources and attempts to keep participation time within an acceptable timeframe, it was not possible to include additional measures in the current study.

In addition, the content of questions as well as the setting may have primed specific cultural schema for participants. This was not explored, but may be an important factor to consider among bicultural individuals as cultural context may impact responses to self-report measures as well as cognitive test performance. Cognitive tests are not developed void of cultural influence and thus scores and interpretations must take cultural context into account. For instance, within Latino culture, more emphasis is placed on completing tasks accurately than quickly (Ardila, 2007). Thus, perhaps if a bicultural individual is primed with Latino specific cues, they will perform a timed task more slowly than if primed with mainstream American cultural cues. Dominance of one culture versus the other was also not examined and may be useful particularly within the context of priming and understanding when cues become more or less relevant depending on cultural dominance within an individual.

A final limitation of the current study is the cross-sectional design. A longitudinal approach would allow for a better representation of the processes of developing biculturalism and bilingualism, and how those systems are maintained throughout the lifespan. Further, it would allow for baseline measures of cognition with the ability to track change over time.

Implications and Future Directions

Despite these limitations the current study is the first to examine biculturalism as a predictor of executive functioning, and the first to suggest that biculturalism, like bilingualism as demonstrated in prior studies, may improve executive functioning and ultimately lead to increased cognitive reserve. At least some support was found for biculturalism predicting performance on a task of executive functioning (phonemic fluency), as well as data to support the contrary, an unexpected but interesting finding. While the current study did not lend support for the bilingualism/cognitive reserve theory, it is difficult to make any generalizations given the limited subset of bilingual individuals in an already small number of participants.

Interestingly, TMT B/A scores and CLOX ratio scores were not correlated with age or education level, and were not found to differ by place of education or sex, despite the non U.S. educated group as compared to the U.S. educated group, and women as compared to men, being older and having fewer years of formal education. Prior research suggests that the CLOX is a valid instrument for use among Latinos despite education status (Royall et al., 2003), which is supported by the current findings. This is important to consider in clinical settings when working with individuals with varying levels of education who may not perform as well on tasks that are more dependent on educational attainment or experience. On the other hand, the similar results in TMT B/A ratios despite differences in education and age, is noteworthy. In comparing U.S. to non U.S. educated individuals, it is possible that there was an effect of immigration. The *healthy immigrant effect* and the *immigrant paradox* describe the phenomena by which immigrants demonstrate better physical (Kennedy, Kidd, McDonald, & Biddle, 2015) and

mental health outcomes (Alegria et al., 2008) than their non-immigrant counterparts. Thus, perhaps due to other factors not captured, the non U.S. educated individuals may be in fact exhibiting some evidence of cognitive reserve, resulting in similar performance to U.S. educated individuals.

Another noteworthy finding was the finding that biculturalism was related to worse phonemic fluency performance among non U.S. educated individuals. This, in contrast to the positive relationship on the same task among the women in the sample who are high in cultural harmony, highlights the importance of examining the nuances of biculturalism. Just as bilingualism is complex with multiple factors to consider, biculturalism will likely prove to be as challenging if not more challenging than bilingualism research within cognition. For instance, identifying how often one engages in a particular language may readily apparent. However, recognizing how often and to what extent one employs a particular cultural schema is less obvious. Taking a mixed-methods approach and first qualitatively exploring experiences of biculturalism among older Latino adults may provide guidance in developing future quantitative studies on biculturalism, executive functioning, and cognitive reserve. While challenging, further exploring biculturalism and bilingualism within cognition, aging, and cognitive reserve among U.S. Latinos may prove to be a fruitful line of research.

If biculturalism, at least within the context of high cultural harmony, does in fact predict better executive functioning in some individuals, it is important to identify the circumstances in which this holds true. From a clinical intervention perspective, identifying ways in which to take full advantage of the commonly lived experience of biculturalism within the context of cognitive aging can perhaps help offset some of the

risks for cognitive decline and dementia that are so prevalent among U.S. Latinos. Further, understanding the circumstances under which biculturalism may in fact be related to worse cognitive outcomes among other individuals is also essential to consider as this may be a modifiable process.

The current study is first to examine biculturalism as a potential predictor of executive functioning with some support for biculturalism as a predictor of executive functioning (phonemic fluency), in addition to an important finding of biculturalism being related to poorer performance on a phonemic fluency task among non U.S. educated individuals. It provides support for the continued exploration of the biculturalism and the bicultural experience as it relates to cognition in older Latino adults and potential for contributing to cognitive reserve. Expanding beyond Latinos to those with other bicultural identities, particularly those where bilingualism is not a factor (e.g., monolingual English speaking biracial African-American/white European American individuals) may be particularly useful. Further, having a more fundamental understanding of biculturalism and cognition, throughout the lifespan via studying a wide age range, may provide a better foundation for better understanding and further examining biculturalism within the context of aging, executive function, and cognitive reserve.

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Appendix A

PHQ-9

Over the *last 2 weeks*, how often have you been bothered by any of the following problems? (use "**√**" *to indicate your answer)* **CHECK ONE RESPONSE FOR EACH QUESTION.**

	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself, -- or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite, --being so fidgety or restless that you have been moving around a lot more than usual?	0	1	2	3
9. Thoughts that you would be better off dead, or of hurting yourself in some way	0	1	2	3
10. We checked off problems. How *difficult* have these problems made it for you to do your work, take care of things at home, or get along with other people?	Not Difficult at All	Somewhat Difficult	Very Difficult	Extremely Difficult
11. If these problems have been difficult, have they been more difficult for 2 years or more?		NO		YES

Appendix B

CRM-BS

Instructions: The questions that follow refer to different ways to experience life in the United States. Please, read them carefully and check the box that best describes your feelings.

1.	How much are Hispanic/Latino values a part of your life?	0	1	2	3
2.	How important is it to you to celebrate holidays in the Hispanic/Latino way?	0	1	2	3
3.	How important is it to you to raise your children with Hispanic/Latino values?	0	1	2	3
4.	How comfortable would you be in a group of Hispanic/Latinos who do not speak English?	0	1	2	3
5.	How proud are you of being Hispanic/Latino?	0	1	2	3
6.	How much do you enjoy speaking Spanish?	0	1	2	3
7.	How much do you enjoy Hispanic/Latino TV programs?	0	1	2	3
8.	How much do you like to eat Hispanic/Latino food?	0	1	2	3
9.	Do you think Hispanic/Latino are kind and generous?	0	1	2	3
10.	How important would it be to you for your children to have Hispanic/Latino friends?	0	1	2	3
11.	How important is it to you to celebrate holidays in the mainstream American way?	0	1	2	3
12.	How much are mainstream American values a part of your life?	0	1	2	3
13.	How comfortable would you be in a group of mainstream Americans who don't speak (ethnic minority language)?	0	1	2	3
14.	How important is it to you to raise your children with mainstream American values?	0	1	2	3
15.	How proud are you of a mainstream American identity?	0	1	2	3
16.	Do you think mainstream Americans are kind and generous?	0	1	2	3
17.	How much do you enjoy mainstream American TV programs?	0	1	2	3
18.	How much do you enjoy speaking English?	0	1	2	3
19.	How much do you like to eat mainstream American food?	0	1	2	3
20.	How important would it be to you for your children to have mainstream American friends?	0	1	2	3