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Age of dementia diagnosis in community dwelling bilingual and monolingual Hispanic Americans

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Abstract

Bilingualism has been reported to delay the age of retrospective report of first symptom in dementia. This study determined if the age of clinically diagnosed Alzheimer's disease and vascular dementia occurred later for bilingual than monolingual, immigrant and U.S. born, Hispanic Americans. It involved a secondary analysis of the subset of 81 bi/monolingual dementia cases identified at yearly follow-up (1998 through 2008) using neuropsychological test results and objective diagnostic criteria from the Sacramento Area Latino Study on Aging that involved a random sampling of community dwelling Hispanic Americans (N = 1789). Age of dementia diagnosis was analyzed in a 2 × 2 (bi/monolingualism × immigrant/U.S. born) ANOVA that space revealed both main effects and the interaction were non-significant. Mean age of dementia diagnosis was descriptively (but not significantly) higher in the monolingual (M = 81.10 years) than the bilingual (M = 79.31) group. Overall, bilingual dementia cases were significantly better educated than monolinguals, but U.S. born bilinguals and monolinguals did not differ significantly in education. Delays in dementia symptomatology pertaining to bilingualism are less likely to be found in studies: (a) that use age of clinical diagnosis vs. retrospective report of first dementia symptom as the dependent variable; and (b) involve clinical cases derived from community samples rather than referrals to specialist memory clinics.

Keywords

Alzheimer's disease; Vascular dementia; Dementia prevalence; Bilingual advantage; Cognitive reserve

1. Introduction

Bilingualism has been reported to delay the onset of Alzheimer's disease and related dementias compared to monolingualism by contributing to cognitive reserve. In the initial study, Bialystok, Craik, and Freedman (2007) studied the age of first clinical symptom as determined by patient, family member, or caregiver report in bi/monolingual dementia referrals to a specialist memory clinic in Toronto, Canada (N = 184). Bilingualism was

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determined by a panel of 11 judges using the criterion: “had spent the majority of their lives, at least from early adulthood, regularly using at least two languages” (p. 460). Bilinguals were predominantly (87%) immigrants to Canada from Europe who spoke any one of 25 different languages in addition to English, whereas monolinguals were predominantly (86%) Canadian born, English speakers. Years of education was significantly lower in the bilingual (*M* = 10.8 years) than the monolingual (*M* = 12.4) group. The bilingual group had an average age of retrospectively reported first clinical symptom 4.1 years later than the monolingual group.

This finding has been replicated. Alladi et al. (2013) compared relative retrospective report of first clinical symptom for all types of dementias among 648 bi/monolingual referrals to a specialist memory clinic in India. Bilingualism was defined as an ability to meet the communication demands of the self and society in everyday functioning in two or more languages. The bilingual group (57% of whom were actually multilingual) had an average age of relative retrospective report of first clinical symptom 4.5 years later than the monolingual group. Bilingual and monolingual groups were born in India. Years of education was significantly higher in the bilingual (*M* = 13) than the monolingual (*M* = 6) group. Craik, Bialystok, and Freedman (2010) studied 211 patients diagnosed with Alzheimer's disease at the same memory clinic as in Bialystok et al. (2007) and found that bilingual patients had relative retrospective report of first clinical symptom an average of 5.1 years later than monolinguals.

Contradictory findings also have been reported. Chertkow et al. (2010) found no significant difference in age of diagnosis of Alzheimer's disease among 632 bi/monolingual referrals to a memory clinic in Montreal, Canada. Education level of the two groups was similar (both *M* = 11 years). A subgroup of multilingual participants had an average five year delay in age of Alzheimer's disease diagnosis in comparison to monolinguals. Gollan, Salmon, Montoya, and Galasko (2011) studied the impact of bilingualism (measured objectively by Boston Naming Test scores in each language) as a continuous variable on: (a) age of relative retrospective report of first clinical symptom; and (b) age of dementia diagnosis, among 44 Hispanic Americans. Those (*N* = 22) who preferred to be tested in English had significantly higher education (*M* = 13 years) than those (*N* = 22) who preferred to be tested in Spanish (*M* = 7). Degree of bilingualism was related to later age of dementia onset only in the lower education (*N* = 22; *M* = 6 years) group, who primarily (73%) preferred to be tested in Spanish. There was no relationship between degree of bilingualism and age of dementia diagnosis or relative retrospective report of first clinical symptom for the higher education (*N* = 22; *M* = 15 years) group who preferred to be tested in English.

In a prospective study of 1067 community dwelling, Spanish-speaking immigrants primarily from the Caribbean who were followed over 23 years, Zahodne, Schofield, Farrell, Stern, and Manly (2014) found bi/monolingualism had no effect on the age of diagnosis of the 282 participants who developed dementia. Defining bilingualism by self-report or from scores on the Wide Range Achievement Test-3 did not affect the results. The bilingual group was significantly better educated (*M* = 8.3 years) than the monolingual (*M* = 5.1) group.

As yet, no clear explanation has emerged to explain the discrepant results, with studies differing on potentially important variables like: immigrant status of participants; objective measurement vs. self-report of bilingualism; bi vs. multilingualism; education level differences between bi/monolingual groups; age of relative report of first dementia symptom vs. age of clinically determined dementia diagnosis as the dependent variable; and clinic referral vs. community sample cases. Fuller-Thomson and Kuh (2013) suggested the protective influence of bilingualism may form part of the “healthy immigrant effect” (p. 129), whereby immigrants tend to have lower rates of morbidity than non-immigrants of the same ethnicity. The present study examined the age of diagnosis of Alzheimer's disease and vascular dementia among a community dwelling sample of bi/monolingual, immigrant and U.S. born, Hispanic Americans, primarily of Mexican origin. The question was whether age of diagnosis of incident dementia would be delayed for bilinguals compared to monolinguals.

2. Method

2.1. Participants

The clinical data set was derived from the Sacramento Area Latino Study on Aging (SALSA) and involved a secondary analysis of data. SALSA was a cohort study of 1789 community-dwelling, self-identified Hispanic Americans, aged ≥60 in 1998–99, who resided in the Sacramento, California metropolitan area and surrounding suburban and rural counties (Haan et al., 2003). About half (51%) were immigrants, overwhelmingly from Mexico (89%). Follow-up data collection occurred every 12–15 months from 1998 through 2008. Over the course of the study, 55 cases were diagnosed with Alzheimer's disease and 26 with vascular dementia, for a total N of 81. A diagnosis of vascular dementia was considered as a rule-out for a diagnosis of Alzheimer's disease.

2.2. Procedure

2.2.1. Dementia diagnosis—Every fifth participant and those whose scores fell < 20th percentile on either of two screening tests: (a) Modified Mini Mental Status Exam (3MSE: Teng and Chui, 1987; maximum = 100: nondemented M = 85.6); or (b) delayed free recall trial from the Spanish and English Verbal Learning Test (González, Mungas, Reed, Marshall, & Haan, 2001), underwent further neuropsychological assessment. This consisted of: (a) the Spanish English Neuropsychological Assessment Scale (Mungas, Reed, Crane, Haan, & González, 2004) that has five tests of verbal semantic memory, non-verbal semantic memory, verbal attention span, verbal abstraction, and visual-perceptual skills; and (b) the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE: Jorm & Jacomb, 1989). Higher scores on this 26 item scale reflect greater subjective decline in cognitive functioning as rated by caregiver/family members. Participants were referred for dementia adjudication if they obtained: (a) a score < 10th percentile on > 1 of the 6 neuropsychological tests and a score on the IQCODE ≥ 3.40 (about 20% of the overall sample had scores in this range); (b) scores < 10th percentile on ≥ 4 of 6 neuropsychological tests; or (c) IQCODE > 4.0 (about 5%). Dementia diagnosis was assigned by a team of neurologists and neuropsychologists using California Alzheimer's Disease Diagnostic and Treatment Center criteria (Chui et al., 1992) for vascular dementia and National Institute of

Neurological Disorders and Stroke/Alzheimer's Disease and Related Disorders Association criteria (McKhann et al., 1984) for Alzheimer's disease. Both “possible” and “probable” cases were included.

2.2.2. Age of dementia diagnosis—Age of dementia diagnosis (range 65.39–99.49; *M* = 80.51; *SD* = 6.50 years) was participant age at the time of the first SALSA contact (e.g., annual visit or neuropsychological followup) that resulted in a dementia diagnosis. Previous doctor reports or participant/relative self-reports were not used in the diagnosis of dementia.

2.2.3. Bi/monolingual status—Bi/monolingualism was coded from responses at baseline visit to two items from the Acculturation Rating Scale for Mexican Americans-II (Cuellar, Arnold, & Maldonado, 1995): (a) Question 1. *Do you speak Spanish*?; and (b) Question 3. *Do you speak English*? Answers were coded on a 0–3 point Likert scale. If participants answered 0 (*Not at all*) or 1 (*Not very often*) for either question, they were coded as monolingual. If the response to Question 1 was 2 (*Very often*) or 3 (*Almost always*), participants were considered bilingual if a response of either 2 or 3 to Question 3 confirmed bilingualism. Applying these criteria to the total SALSA sample of 1789 gave 1152 monolingual (65%) and 625 bilingual speakers (35%), with 12 sets of missing data.

3. Results

The proportions of monolinguals (.047) and bilinguals (.043) diagnosed with Alzheimer's disease and vascular dementia over the course of the study were not significantly different, $\chi^2(1, n = 81) = .13$, $p = .72$. This effect was not moderated by immigration status. For both immigrants and U.S. born, the proportions of monolinguals (.046; .048 respectively) and bilinguals (.056; .040) diagnosed with Alzheimer's disease and vascular dementia did not differ significantly: χ^2 (1, $n = 43$) = .30, $p = .59$; χ^2 (1, $n = 38$) = .39, $p = .53$.

Table 1 shows demographic characteristics of the bi/monolingual groups. There were no significant differences between the bi/monolingual groups on baseline 3MSE scores, t (79) = .24, $p = .81$, or on presence of type 2 diabetes, χ^2 (1, $n = 81$) = .62, $p = .43$. The bilingual group was significantly better educated than the monolingual group, $t(79) = 2.60$, $p < .05$. This effect was moderated by immigration status. For immigrants, mean years of education was significantly higher in the bilingual ($N = 9$; $M = 8.33$; $SD = 5.68$) than the monolingual group ($N = 34$; $M = 3.29$; $SD = 2.88$), t (41) = 3.73, $p < .001$. For U.S. born participants, mean years of education did not differ between the bilingual ($N = 18$; $M = 7.39$; $SD = 4.58$) and monolingual ($N = 20$; $M = 7.88$; $SD = 4.50$) groups, t (36) = .33, $p = .74$. Among immigrants, there were no significant associations among bilingualism, years of education, and age of dementia onset. Among U.S. born participants, there was a positive and significant correlation between bilingualism and years of education, $r = .50$, $p < .01$, but neither bilingualism nor education were significantly related to age of dementia onset. Over three-quarters of the monolinguals were Spanishspeaking, but there was no significant difference between the age of dementia diagnosis of the English- ($M = 80.66$ years) and Spanish- ($M = 81.56$) speaking monolingual groups, t (52) = .40, $p = .69$.

A 2 × 2 (bi/monolingualism × immigration status) ANOVA showed that the mean age of dementia diagnosis of the bilingual participants (79.31 years) was not significantly different from that of the monolingual participants (81.10), F (1, 77) = 1.27, p = .26, η^2_p = .02. Similarly, the mean age of dementia diagnosis for the U.S. born (79.0 years) and immigrant (81.41) groups did not differ significantly, F (1, 77) = 2.30, p = .13, η^2_p = .03. There was no significant interaction between bi/monolingualism and immigrant status on age of dementia diagnosis, F (1, 77) = .1, p = .75, η^2_p = .001.

4. Discussion

Mean age of dementia diagnosis was not significantly different for bi/monolingual, U.S. born or immigrant, Hispanic Americans. This runs counter to previous findings that retrospective report of first clinical symptom occurred about four years later in bilinguals than monolinguals in Canada (Bialystok et al., 2007; Craik et al., 2010) and India (Alladi et al., 2013). Results also run counter to Gollan et al. (2011) who found that degree of bilingualism was related to later age of dementia diagnosis in Hispanic Americans with low education (M = 6 years). The educational level of the current sample was similar (M = 5.89).

Results concur with another longitudinal investigation of incident dementia among community dwelling Hispanic Americans (Zahodne et al., 2014) in showing that age of clinically diagnosed dementia was not significantly different among bi/monolingual participants. As in this study, participants were all immigrants within which mean years of education was significantly higher in the bilingual than the monolingual group. Splitting our sample into U.S. born and immigrant groups did not impact the effect of bi/monolingualism on age of dementia diagnosis. The protective influence of bilingualism is not moderated by immigrant status (Fuller-Thomson & Kuh, 2013). For U.S. born participants, mean years of education did not differ between the bilingual and monolingual groups and for both U.S. born and immigrant participants neither bilingualism nor education level were associated with age of dementia onset.

The proportions of cases of Alzheimer's disease and vascular dementia that were diagnosed over the course of the study did not differ significantly between monolinguals and bilinguals. This is a variable that should be positively associated with age of onset over any given period. Results concur with two other longitudinal studies on U.S. residents (Crane et al., 2009; Sanders, Hall, Katz, & Lipton, 2012) that showed prevalence of dementia of any type in community samples was unaffected by bi/monolingual status. Crane et al. (2009) used follow-up data collected in the 1990s from the Honolulu Asia Aging Study on 3,139 U.S. born (between 1900 and 1919), Japanese American men, who were resident on the Hawaiian island of Oahu. Sanders et al. (2012) analyzed data from the Einstein Aging Study on 1779 residents of the Bronx, New York who were ≥ 70 years of age. Bilinguals were non-native English speakers (22% of the total) who spoke anyone of 25 different languages and had sufficient English fluency to undergo neuropsychological testing, although only about one third reported on-going use of the foreign language.

All these studies and the one conducted here have two main differences from those that have reported a bilingual delay in dementia onset: (a) the clinical samples were derived from

community samples and not referrals to specialist memory clinics; and (b) the dependent variable involved the age of clinical diagnosis, as established by neuropsychological testing and formal dementia criteria, and not the highly subjective patient/relative retrospective report of first clinical symptom. In clinical neuropsychology in general and Alzheimer's disease in particular, patient/relative report of symptoms has frequently been found to correlate more with emotional factors than neuropsychological test scores (e.g., Starkstein et al., 1997). Non-professional caregivers of dementia patients are known to ascribe dementia symptoms to causes other than dementia (e.g., personality, depression) and such attributions may vary systematically across ethnic groups (Hinton, Chambers, & Velásquez, 2009).

The monolingual group was predominantly Spanish-speaking, but there was no significant difference between the ages of dementia diagnosis for the English- and Spanish-speaking monolingual participants. Chertkow et al. (2010) reported that Canadian-born, French-speaking monolinguals were diagnosed with dementia an average of 5.3 years earlier than Canadian-born, English-speaking monolinguals.

In our study, bi/monolingualism was determined by self-report and not objective language test scores. This is a weakness, although Zahodne et al. (2014) reported this was not a factor in their study on age of dementia diagnosis in Hispanic Americans. Another weakness is that the study may have lacked power to achieve significance, the study sample being fixed due to the retrospective nature of the analysis. Nevertheless, effect size estimates confirmed that differences between bi/monolingual groups in age of dementia diagnosis were negligible.

The results of the current investigation and those of other U.S. longitudinal studies bring into question explanations of the protective effect of bilingualism for dementia that have involved cognitive reserve and the bilingual advantage (Alladi et al., 2013; Bialystok et al., 2007; Bialystok, Craik, & Luk, 2012; Craik et al., 2010; Gollan et al., 2011; Schweizer, Craik, & Bialystok, 2013). Cognitive reserve is a hypothetical concept that encompasses such variables as higher levels of education, occupational attainment, participation in intellectually stimulating activities, and physical exercise that moderate the deleterious effects of neuropathology on clinical outcomes in Alzheimer's disease and other neurological conditions. The mechanism of reserve (e.g., synaptic growth or alternative cognitive strategies) is unknown (Jones et al., 2011). Schweizer, Ware, Fischer, Craik, and Bialystok (2010) reported that bilingual Alzheimer's disease patients showed greater neuroimaged brain atrophy than a matched (on years of education and cognitive test scores) monolingual group, suggesting reserve involves physiological changes within the brain, but this remains speculative. Cognitive reserve also might involve cultural (societal and individual) factors.

The *bilingual advantage* refers to the finding that neurologically intact bilingual participants outperform monolinguals on cognitive tasks that require response inhibition, an aspect of executive function (e. g., Bialystok, Craik, Klein, & Viswanathan, 2004). It is thought to develop as bilinguals activate both languages during language processing tasks and are required to suppress the non-dominant language (Green, 1998). Recent reviews of contradictory results suggest the bilingual advantage is limited to a small proportion of the

bilingual population and is demonstrable only with a restricted set of executive function measures (Hilchey & Klein, 2011; Paap, Johnson, & Savi, 2014).

In contrast to the bilingual advantage on executive function tasks, Hispanic American bilinguals have been shown to perform below monolinguals on cognitive tasks that involve language processing skills in both languages (e.g., Gasquoine & Gonzalez, 2012). How relative cognitive strengths and weaknesses of Hispanic American bilinguals across the domains of executive and language functions combine to influence the age of diagnosis of Alzheimer's disease, whose primary and defining symptom is anterograde amnesia, or vascular dementia, that can have lateralized effects, is unclear. Future prospective longitudinal studies addressing this issue would benefit from the use of objective measures of bilingualism, delineation of sociocultural factors affecting language proficiency and use, while preserving the use of neuropsychological testing and formal criteria in the diagnosis of dementia.

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Table 1

Demographic characteristics of the bilingual and monolingual dementia groups.

	Monolingual (*N* = 54)	Bilingual (*N* = 27)
% female	65	63
Mean years of education (SD)	4.99 (4.17)*	7.70 (4.88)*
Mean 3MSE score: max. = 100 (SD)	78.87 (9.90)†	79.56 (15.57)†
% type 2 diabetes	46†	56†
% Spanish speaking	76	
% English speaking	24	

Key: 3MSE = Modified Mini Mental Status Exam.

† ns.

* $p < .0001$.