



Degree of bilingualism predicts age of diagnosis of Alzheimer's disease in low-education but not in highly educated Hispanics

Tamar H. Gollan*, David P. Salmon, Rosa I. Montoya, Douglas R. Galasko

University of California, San Diego, United States

ARTICLE INFO

Article history:

Received 3 February 2011
Received in revised form
23 September 2011
Accepted 27 September 2011
Available online 4 October 2011

Keywords:

Bilingualism
Dementia onset
Hispanic
Education

ABSTRACT

The current study investigated the relationship between bilingual language proficiency and onset of probable Alzheimer's disease (AD) in 44 Spanish–English bilinguals at the UCSD Alzheimer's Disease Research Center. Degree of bilingualism along a continuum was measured using Boston Naming Test (BNT) scores in each language. Higher degrees of bilingualism were associated with increasingly later age-of-diagnosis (and age of onset of symptoms), but this effect was driven by participants with low education level (a significant interaction between years of education and bilingualism) most of whom (73%) were also Spanish-dominant. Additionally, only objective measures (i.e., BNT scores), not self-reported degree of bilingualism, predicted age-of-diagnosis even though objective and self-reported measures were significantly correlated. These findings establish a specific connection between knowledge of two languages and delay of AD onset, and demonstrate that bilingual effects can be obscured by interactions between education and bilingualism, and by failure to obtain objective measures of bilingualism. More generally, these data support analogies between the effects of bilingualism and “cognitive reserve” and suggest an upper limit on the extent to which reserve can function to delay dementia.

© 2011 Elsevier Ltd. All rights reserved.

The Alzheimer's Association (2004) warns “During the first half of the 21st century, the number of Hispanic elders suffering from Alzheimer's and related dementias could increase more than six-fold, from fewer than 200,000 today to as many as 1.3 million by 2050.” Age is the single greatest risk factor for Alzheimer's disease (AD; from age 65 prevalence doubles every 5 years reaching 47% of people ≥ 85). The proportion of people 65 or older in the US is projected to increase from 12% to 20% in 2030. In addition, the Hispanic population is predicted to triple in size, and will account for an increasingly larger proportion of the total population over 65. As the population ages and becomes more ethnically diverse, the number of Hispanics with AD is also rising rapidly.

One factor that may provide some protection against AD in Hispanics is bilingualism. Many Hispanics speak both Spanish and English, and recent research suggests that bilingualism may delay the onset of AD. Bialystok, Craik, and Freedman (2007) and Craik, Bialystok, and Freedman (2010, p. 1727), recruited patients from a memory clinic in Toronto, Canada comparing people who “...spent the majority of life, at least from early adulthood, regularly using at least two languages” to monolinguals, and found that bilinguals reported onset of first symptoms 4–5 years later than monolinguals. A second study in Montreal, Canada, found a delay in age of diagnosis of AD for immigrant bilinguals when compared

with less educated immigrants who remained monolingual, but no significant bilingual advantage when comparing native Canadian bilinguals to monolinguals (although trends in this direction were reported for participants with French as the first-learned language; Chertkow et al., 2010). In this same study, there was a clear delay in diagnosis for multilinguals whether Canadian natives or immigrants.

These pioneering studies complement recent reports that bilingualism enhances executive function (Costa, Hernández, Costa-Faidella, & Sebastián-Gallés, 2009; for review see Bialystok, Craik, Green, & Gollan, 2009), imply a beneficial effect of bilingualism on cognitive reserve (Stern, 2009; Valenzuela & Sachdev, 2006a, 2006b), and raise interesting questions regarding mechanisms underlying these effects. What about bilingualism introduces the advantage, and why is it sometimes difficult to observe? Is the advantage only found in highly proficient bilinguals, and only in bilinguals who learn both languages from birth? Will delay of AD also be observed in Spanish–English bilinguals in the USA? Is the effect dependent on an extreme contrast between bilinguals and monolinguals? We investigated if degree of bilingualism is related to onset of AD within a uniform bilingual population using a continuous and objective measure of bilingual language proficiency.

1. Methods

1.1. Participants

The UCSD Alzheimer's Disease Research Center (ADRC) follows about 100 Hispanic participants about equally divided between patients with dementia and

* Corresponding author at: Department of Psychiatry, University of California, San Diego, 9500 Gilman Drive, 0948, La Jolla, CA 92093-0948, United States.

E-mail address: tgollan@ucsd.edu (T.H. Gollan).

Table 1
Mean and standard deviation of participant characteristics for 44 bilinguals divided by language preference on the left, and by education level on the right.

Characteristic	PreferEnglish(<i>n</i> = 22)		PreferSpanish(<i>n</i> = 22)		Higheducation(<i>n</i> = 22)		Loweducation(<i>n</i> = 22)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age of diagnosis	75.1	(8.6)	77.1	(7.0)	75.1	(8.1)	77.1	(6.8)
Age of onset	72.5	(9.4)	74.6	(7.8)	72.1	(9.5)	75.0	(7.5)
Education	12.9	(4.2)	7.4**	(4.7)	14.6	(2.6)	5.6††	(2.7)
MMSE at diagnosis	23.8	(4.3)	23.8	(4.1)	23.4	(4.0)	24.2	(4.4)
DRS at diagnosis ^b	117.7	(11.5)	110.3 [†]	(12.7)	119.3	(9.9)	108.7††	(12.9)
BNT-based bilingual index ^a	.59	(.25)	.47	(.31)	.64	(.24)	.42††	(.28)
Self-rated bilingual index ^{a,b}	.72	(.24)	.55 [*]	(.27)	.74	(.21)	.52††	(.27)
Percent daily use of English ^c	86.2	(15.1)	13.0 ^{**}	(24.5)	75.6	(30.6)	21.1††	(33.9)
Age of acquisition of English ^c	1.5	(2.7)	22.7 ^{**}	(17.2)	2.9	(3.9)	19.9††	(18.8)
English self-rated speaking ^{c,d}	6.7	(0.5)	3.7 ^{**}	(1.9)	6.3	(.9)	4.0††	(2.3)
Spanish self-rated speaking ^{c,d}	4.8	(1.6)	6.5 ^{**}	(0.8)	5.4	(1.7)	5.9	(1.4)
Years in Spanish-speaking country ^e	4.1	(9.2)	34.2 ^{**}	(18.6)	15.0	(21.7)	23.2	(19.7)
Dominant language BNT score ^e	.64	(.21)	.56	(.22)	.67	(.16)	.53 [†]	(.24)
Nondominant language BNT score ^e	.36	(.20)	.29	(.22)	.43	(.20)	.22††	(.17)
English BNT score ^e	.63	(.21)	.30 ^{**}	(.23)	.62	(.16)	.30††	(.27)
Spanish BNT score ^e	.37	(.21)	.56 ^{**}	(.22)	.48	(.24)	.45	(.23)

^a Index scores calculated by dividing the nondominant score by the dominant score (see text).

^b DRS scores are a bit low relative to scores obtained in highly educated cognitively intact monolingual English speakers. This could be due to a bilingual disadvantage, translation of the test (Peña, 2007) for bilinguals who preferred to be tested in Spanish, and the relatively low education level for some bilinguals in this cohort (the correlation between education level and DRS scores in all 43 bilinguals was robust, $r = .497$, $p < .01$; by contrast MMSE scores were not influenced by education level, $r = -.069$, $p = .66$).

^c Degrees of freedom for this comparison were less than 42 but at least 35.

^d Proficiency level based on self-ratings using a scale of 1–7 with 1 being “little to no knowledge” and 7 being “like a native speaker.”

^e Proportion of pictures named correctly.

^{*} Significant difference between prefer English and prefer Spanish groups at $p < .05$ level.

^{**} Significant difference between prefer English and prefer Spanish groups at $p < .01$ level.

[†] Significant difference between low education and high education groups at $p < .05$ level.

^{††} Significant difference between low education and high education groups at $p < .01$ level.

healthy non-demented controls. Clinical diagnoses are made by two neurologists based on medical, neurological, and neuropsychological exams, laboratory tests, and neuroimaging. We focused on 44 bilinguals with a diagnosis of probable AD (excluding those with possible AD, Parkinson's disease, dementia with Lewy bodies, and non-amnesic MCI). Half preferred to be tested in English ($n = 22$) and half in Spanish ($n = 22$). Table 1 shows participant characteristics (language history questionnaire data were missing for a handful of participants who could not be contacted).

1.2. Materials and procedure

Participant age when given the diagnosis of probable AD was obtained from medical records. Age-of-onset of first symptoms was obtained from an informant (spouse or adult-child) through structured interview by the neurologist during the first year of ADRC participation. During annual evaluations participants were tested on the Boston Naming Test (BNT) first in their self-reported dominant language, and then in their non-dominant language. To measure the degree of bilingualism objectively we calculated bilingual index scores by dividing the proportion of pictures named correctly in whichever language produced a lower naming score by the proportion named correctly in whichever language produced the higher naming score (Gollan, Weissberger, Runnqvist, Montoya, & Cera, in press). The index provides an objective but also intuitive estimate of relative ability in each language without being influenced by overall naming ability. To illustrate, a bilingual who names 3 pictures in one language and 6 in the other would be 50% bilingual, as would a person who names 30 in one and 60 in the other. Alternative responses were allowed (e.g., *galleta*, *rosquilla*, or *pretzel*) in Spanish to adjust for the problem that the BNT was not designed for use with bilinguals or Spanish speakers (Allegrri et al., 1997; Gollan et al., in press; Gollan, Fennema-Notestine, Montoya, & Jernigan, 2007; Kohnert, Hernandez, & Bates, 1998).

Testing in both languages at the ADRC began for some participants in 2002 and became annual for all Hispanic participants in 2007. We used naming scores from the first year of dual-language testing. On average bilinguals were tested in both languages for the first time under a year after being diagnosed ($M = .82$ years, $SD = 3.01$). Delay between dual-language testing and diagnosis did not vary with language preference (English versus Spanish), or with education level (both $t_s < 1$), an important consideration given that the dominant language may decline more rapidly than the nondominant language for some bilinguals with AD (Gollan, Salmon, Montoya, & Da Pena, 2010).

2. Results

Initially we correlated age-of-diagnosis and age-of-onset with the BNT based bilingual index, and other variables which we thought might vary with language preference. Given the

exploratory nature of this initial analysis we used an unadjusted alpha level of $p = .05$. To evaluate the utility of the objective versus subjective measures we compared the BNT index to an index calculated using bilinguals' self-rated spoken proficiency in each language. Previous studies have used age-of-onset (Bialystok et al., 2007) or both age-of-onset and age-of-diagnosis (Chertkow et al., 2010) as dependent variables. Both outcome variables are inherently flawed in some ways; age of onset assumes different families will notice onset of symptoms at a similar level of impairment (which may or may not be true), and age of diagnosis may be subject to variability in access to healthcare (e.g., Spanish-dominant bilinguals in the USA may be more reluctant to seek healthcare because the majority of healthcare givers will speak English only). We focus our discussion primarily on age of diagnosis because of our preference for using an objective and professionally determined clinical classification, but note that the pattern of results and significance reported was the same when we repeated our analyses with age of onset as the measure (see also Chertkow et al., 2010).

Language-dominance subgroups. In Spanish-dominant bilinguals age at diagnosis was increasingly older in bilinguals who were objectively more bilingual. Table 2 shows the results separated by language preference. Subjective and objective bilingual index scores were significantly correlated with each other, but only the objective measure significantly predicted age-of-diagnosis. Bilingualism was also correlated with education level such that higher levels of bilingualism (on both objective and subjective index scores) were found in more educated bilinguals. At the time of diagnosis, Mini-Mental Status Exam (MMSE; Folstein, Folstein, & McHugh, 1975) scores were not correlated with age-of-diagnosis, education level, or bilingual index scores, but were strongly correlated with Dementia Rating Scale (DRS; Mattis, 1988) scores. DRS scores appeared to be more sensitive (than MMSE) and were significantly correlated with index scores, and marginally correlated with education and age-of-diagnosis such that better educated and more bilingual individuals obtained higher DRS scores, and those diagnosed at a later age had marginally higher DRS scores.

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات