

Bilingualism as a protective factor in age-related neurodegenerative conditions: the BANC study

Summary and key points

- Some recent studies have found that being bilingual can help to strengthen mental fitness, protect against age-related decline in mental fitness, and delay the onset of age-related conditions such as Alzheimer's disease (AD). This is thought to be because being bilingual helps strengthen certain mental abilities, called 'executive functions'. However, other studies have found that being bilingual does not confer any advantage in mental fitness. When we began this study there was no evidence available about the effects of bilingualism for older Welsh speakers.
- In the BANC study we examined how much of a protective factor being bilingual is for Welsh-speaking older people, including healthy older people, people with early-stage AD, and people with Parkinson's disease (PD). We did this by comparing executive function in monolingual English speakers and bilingual Welsh/English speakers within each of these three groups. In the AD group we also examined the age at which people were diagnosed with dementia.
- For healthy older people, being bilingual did not result in better performance on executive function tasks. There were either no differences between bilinguals and monolinguals, or a tendency for monolinguals to perform better.
- For people with AD, being bilingual did not result in better performance on executive function tasks. Bilinguals were diagnosed with AD on average three years later than monolinguals, although this difference was not statistically significant. The bilinguals were also more impaired than the monolinguals at the time when they were diagnosed, suggesting that they may have sought help at a later stage rather than developing the condition later. However, it was difficult to identify bilinguals with AD through NHS clinics, and the number of bilinguals participating in the study was relatively small, so we cannot draw firm conclusions from these results.
- For people with PD, being bilingual did not result in better performance on executive function tasks.
- The results do not support the view that being a bilingual Welsh/English speaker helps to protect against age-related decline in mental fitness, or that it helps to maintain executive function abilities in the presence of either AD or PD.
- The results are inconclusive with regard to the possibility that Welsh/English bilinguals develop AD significantly later than monolinguals. If there is a delay in onset, it appears to be much smaller than that identified in some other populations.
- The observation that bilingual Welsh speakers who develop AD come to the attention of services later than monolinguals has implications for provision of clinical services to this group.

Overview of the BANC study and its findings

Background

Recent evidence for a bilingual advantage in executive control tasks involving inhibition and management of response conflict has led to the suggestion that being bilingual might contribute to increased cognitive reserve and hence to delaying the onset of Alzheimer's disease (AD). However, the bilingual advantage is not always found, and remains controversial. Furthermore, it is unclear whether the bilingual advantage extends to a wider range of executive function tasks, whether it persists in people who have AD, or whether it has an effect in other conditions in which executive function becomes impaired, such as Parkinson's disease (PD).

Aims

We aimed to compare monolingual and bilingual performance on a wide range of executive function tasks in monolingual English speakers and bilingual Welsh/English speakers who were either healthy older people, people with AD or people with PD, in order to identify the cognitive profiles of monolinguals and bilinguals across the key domains of executive function and outline the implications for cognitive reserve. The importance of controlling for possible confounding factors, such as immigration and other relevant demographic variables, in comparisons of monolingual and bilingual performance has frequently been emphasised, and was addressed as fully as possible in this study by recruiting from a socially and culturally relatively homogenous community in North and West Wales (UK) and by applying appropriate statistical controls. For the AD group, we also examined whether monolinguals and bilinguals differed in age at diagnosis, taking into account level of impairment at the time of diagnosis.

Method

The participants in this cross-sectional cohort study were 288 bilingual Welsh/English and monolingual English speakers living in Wales, UK. These were cognitively healthy older people aged over 60 years ($n = 50$ bilingual, 49 monolingual), people with Parkinson's disease, ($n = 46$ bilingual, 57 monolingual), and people with Alzheimer's disease ($n = 37$ bilingual of whom 24 completed the executive function tasks, 49 monolingual). Within each of these three groups we compared monolingual and bilingual performance on tests of executive function covering the four domains of mental flexibility and speed, working memory, set-shifting and switching, and inhibition and management of response conflict. For the Alzheimer's disease group we also compared monolinguals and bilinguals with regard to the age at which dementia was diagnosed and cognitive function at the time of diagnosis, as indexed by score on the Mini-Mental State Examination. In order to search for any systematic differences between monolinguals and bilinguals that we needed to control for in subsequent analyses, we compared monolinguals and bilinguals on age, gender, education, socio-economic status, health status, functional ability, mood, English language ability, and a proxy measure of cognitive reserve providing a score for cognitive lifestyle which reflects the extent of engagement in complex mental activity across the lifespan.

Results

There were few differences between monolinguals and bilinguals on demographic and background variables in any of the three groups. Monolinguals in the AD and PD groups had significantly higher levels of educational attainment, and this was controlled for in subsequent analyses. In the AD group monolinguals were significantly more likely to be prescribed acetylcholinesterase inhibiting medication, and there was also a trend for monolinguals to have better MMSE scores, although this was not significant; these factors were also controlled for in subsequent analyses. There were no differences between monolinguals and bilinguals in any group on the proxy measure of cognitive reserve. As anticipated, monolinguals tended to perform better on English language tests than bilinguals.

In our group of healthy older people (Clare et al., submitted), there were no overall differences in performance between monolinguals and bilinguals. For the individual measures, there was a tendency for monolinguals to perform better, with small to medium effect sizes favouring monolinguals on 10 of the 17 indices used. However, after correction for multiple comparisons, there were significant differences on only two of the 17 executive function indices assessed; monolinguals performed significantly better on spatial span (working memory), and design fluency (set-shifting and switching) tasks. Variations in the degree of daily use of the two languages in the bilingual group had no significant effect on bilingual performance. Monolinguals and bilinguals did not differ in cognitive lifestyle score.

In our group of people with Parkinson's disease (Hindle et al., submitted), controlling for education, there were no significant differences between bilinguals and monolinguals in performance on executive function tests. Excluding those with significant executive impairment did not alter the results. Variations in the degree of daily use of each language or relative proficiency in each language had no significant effect on bilingual performance.

In our group of people with Alzheimer's disease (Clare et al., in press, *Journal of Neuropsychology*¹), age at diagnosis did not differ significantly between the two groups; although bilinguals were diagnosed on average 3 years later, they were also significantly more cognitively impaired at the time of diagnosis, as indexed by lower MMSE scores. This suggests firstly that if there is a delay in onset of AD in the bilingual group, it is smaller than that reported in some other populations, and secondly that bilinguals may come to the attention of services later in the course of the condition than monolinguals. However, the extent to which we can draw firm conclusions based on these results is limited by the fact that was only possible to recruit a relatively small number of bilingual participants with AD. In tests of executive function, the only significant difference between the groups after correction for multiple comparisons was in category switching accuracy in the verbal fluency task; monolinguals performed better, although the effect size was small. Across all tasks, mainly small effect sizes were observed and there was no clear advantage for either monolinguals or bilinguals.

Conclusions

The study did not provide evidence for a bilingual advantage in executive control tasks involving inhibition and management of response conflict, or in other aspects of executive function, in Welsh/English bilinguals, whether healthy older people, people with PD, or people with AD. In the healthy older group, there was a tendency for monolinguals to perform better. The study did not provide clear evidence for a significant delay in onset of AD in Welsh/English bilinguals, and the findings suggested that bilinguals are diagnosed somewhat later in the course of the disease when they are more cognitively impaired. A possible explanation for the absence of any bilingual advantage may lie in the nature of the sociolinguistic context in Wales and its influence on cognitive processing in the bilingual group.

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