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Ageing with bilingualism: benefits and challenges

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ABSTRACT

Much of the world's population speaks more than one language, and there has been a great deal of media attention given to the potential benefits of bilingualism. In this paper we provide a critical overview of the literature on bilingualism as it relates to older adults. We address whether there is indeed a cognitive advantage from speaking more than one language, and whether it can help preserve cognitive and linguistic function as we age, and potentially reduce the impact of dementia. We also focus on the patterns of language impairment after stroke (aphasia) in bilingual speakers and the issues relating to clinical management of bilingual aphasia.

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Language users are diverse: there are over 5000–8000 distinct languages and they vary along many dimensions (Evans & Levinson, 2009). Moreover, many, if not most, people across the world know and use more than one language (van Hell & Tanner, 2012). Yet despite our increasingly multilingual world, it becomes apparent that, in many countries, the health care system is focused on monolingual services and, in addition, interpreter services are both less than ideal and under-utilised (e.g., Phillips & Travaglia, 2011; Roger, Code, & Sheard, 2000; Williams & McLeod, 2012). Moreover, the majority of research into language and language disorders focuses on monolingual speakers (Bialystok, 2001). Given an increasingly ageing population with older adults predicted to outnumber younger adults in many industrialised nations by 2050 (Statista, 2018), this means that there is a worrying mismatch between our service provision and research foci and the needs of the population (e.g., Stewart & Gonzalez, 2002). In this paper, we aim to discuss some key issues that are relevant to speakers of more than one language¹ and the health care professionals who interact with them as they age. Is it the case that, as they age, people benefit from speaking more than one language? Alternatively, does the presence of other languages overburden a cognitive system that is already struggling as we age, and could this be particularly problematic if there is also neurological impairment?

We do not aim to provide a comprehensive review, but rather focus on areas where misinformation and confusion seem particularly prevalent. For those readers who are interested in reading more on this

topic, Bialystok and Sullivan's (2017) edited volume *'Growing old with two languages'* is a good place to start (see also Antoniou, 2019; De Bot & Houtzager, 2018). We begin by discussing some issues that are not specific to older adults, but that cannot be ignored when considering the bilingual speaker at any age.

What is it to 'be bilingual'?

Bilingualism is no longer considered a binary variable, it is not that someone is or is not bilingual, instead participants and populations are considered on a spectrum of knowledge of two (or more) languages. This spectrum is most likely multidimensional with many different facets interacting to produce a complex picture. This means that care must be taken when evaluating the research literature as the populations of bilinguals participating in each study can be very different. In this section, we will briefly summarise some of the dimensions upon which bilinguals may differ from each other. These need to be taken into account when considering the characteristics of bilinguals and the impact of their bilingualism on their language and cognitive systems and when critically appraising the literature.

One obvious, and frequently, cited example of bilingual variability is in the age of acquisition of the second language. It is clear that this has important consequences, influencing, for example, the bilingual speaker's phonological and grammatical skills (see e.g., Hartshorne, Tenenbaum, & Pinker, 2018). For instance, after adolescence, learners are less likely to acquire a

native-like accent (Moyer, 2004). However, evaluating the influence of age of acquisition is fraught with complexity (see e.g., Birdsong, 2018 for review), and, in particular, a simple distinction between early and late bilinguals is no longer felt to be tenable (e.g., Steinhauer, 2014): Factors like duration of exposure to the second language, acquisition through full immersion in a natural language setting versus acquisition in a classroom setting may interact with age of acquisition and need to be considered (Bialystok, 2001).

Similarly, how often a language is used and what context it is used in (what environment and with which conversational partners) also influences the bilingual language system. For example, individuals may fluently use one language at home and fluently use another at work. Yet they may find it hard to use the appropriate vocabulary and phrasing to talk about work in their 'home' language, or find the words to talk about cooking ingredients in their 'work' language (Grosjean, 1997). As Grosjean (2010) noted, bilinguals do not necessarily use both their languages for the same purpose.

A related, and thorny, issue is that of dominance, which has often been confounded and confused with proficiency,² which in turn is confounded with age of acquisition (Bedore et al., 2012; Grosjean, 2010). Dominance has been defined both as describing the relative proficiency of the speaker (Gathercole & Thomas, 2009), and as the language to which the speaker has had the most exposure (Grosjean, 2010). It is true that a speaker who acquires a second language in later life is likely to have achieved lower proficiency in this language than in their first language. However, if they are currently immersed in the second language environment, their second language may, nonetheless, be their dominant language: This can be common in the case of, for example, migrants who have partners, jobs and social lives that all involve speaking in the second language.

A construct related to that of proficiency is language attrition. This term refers to 'the non-pathological decrease in a language that had previously been acquired by an individual' (Köpke & Schmid, 2004, p. 5; Schmid, 2008) a phenomenon that can be observed in both children and adults. It is now recognised that all bilingual speakers experience some change to their native language (Cook, 2003), through a combination of non-use and interference from the other language(s). For example, children who, prior to school entry, are fluently comprehending and speaking a language different from that of the community, may increasingly use the community language. Over time, while retaining comprehension of their first language, their ability to speak this language may reduce (e.g., Borland, 2006; Hemsley, Holm, & Dodd, 2010). In adults who have fully acquired their native tongue, following consistent full immersion

in another language, over time the grammatical structure and word choice in this native tongue may be affected. For example, a German speaker immersed in an English speaking environment may start using English grammatical and semantic structure, saying 'How are you?' in German as 'Wie bist Du?' rather than using the correct German phrase 'Wie geht es Dir?' (literally translated as 'How does it go?'). Similarly, full immersion in a second language may affect word finding in the first language (e.g., longer search time, and code switching) or phonology (e.g., Bergmann, Nota, Sprenger, & Schmid, 2016; Flege & Hillenbrand, 1987; Mägiste, 1986).³

Furthermore, although one might think that the similarity between the languages of a speaker may also influence the nature of their language system, this is an area that seems to have received relatively little attention. For example, acquiring two languages that are similar in phonology and syntax (e.g., Spanish and Italian), could result in a language system that is less diverse in its capabilities than results from acquiring very different languages (e.g., English and Mandarin). It could also be the case that processing may differ for two similar languages from two distinct languages, requiring either more resources because of more competition or fewer (e.g., Köpke, 2013; but for the (lack of) impact of structural similarity in bilingualism, see, for example, Blom, Boerma, Bosma, Cornips, & Everaert, 2017).

One further complexity that is too often ignored is that the history of bilingualism is deeply scarred with nationalism, politics and identity and has frequent reminders of how often language has been used to create hierarchy and power structures. Negative attitudes towards bilingualism have been particularly prevalent in combination with colonialism. For example, in the pre-colonial United States, over 500 languages were spoken, bilingualism was dominant and well respected (Fitzgerald, 1993). Although there were some efforts to protect bilingualism during colonial times, by the early 1990s there were strong sentiments against it (Fitzgerald, 1993). Similarly, in former European colonies such as Africa and India, the colonial language was favoured over native languages resulting in the suppression of indigenous languages (see Bisong, 1995; Phillipson, 1992 for debates around this topic). In addition, there have often been policies that banned indigenous languages in education and replaced them with English. For example, in Western Australia, missionaries prohibited the use of Aboriginal languages until as late as the 1960s (Lavarch, 1995; for another example, see the 1835 English Education Act of the East India Company; Kachru, 1978).

Nevertheless, it is not always as simple as the imposition of a language by a ruling power. For example, even while Ireland was striving for independence and home rule, from Great Britain, separatist Irish politicians

considered the Irish language as backward, with English viewed as the language of opportunity (Tuathaigh, 1974).

Negative attitudes towards bilingualism remain even today (e.g., Titone, Gullifer, Subramaniapillai, Rajah, & Baum, 2017) with populist politics also contributing to narrowing of societies from multilingual-multicultural to one state-one language identity (e.g., The Californian Proposition 227, which eliminated bilingual public education in 1998; Simon-Cerejido, 2018).

These socio-political issues have significant implications in a real-life clinical context. For example, if a language has a social stigma, individuals may be unwilling to acknowledge their extent of use of, and need for, that language. Moreover, the risk of unconscious bias in the clinical community, and amongst healthcare providers and funders, towards provision of speech-language pathology services in the dominant community language should not be underestimated.⁴

In sum, any answer to the question 'What is it to "be bilingual"?' will be complex, and we still cannot be confident that we are able to identify all the relevant dimensions. While on the surface there is a clear definition of a bilingual speaker (a speaker of two or more languages), once one tries to characterise bilingual speakers in more detail, it is clear that they are so far from being a homogenous group, that it seems unreasonable to group them together. Given that ageing, and language impairment are also heterogeneous, our attempt to provide a general characterisation of bilingualism, ageing and language impairment may seem unwise! Consequently, the reader is requested to remain alert to the fact that much of what comes below should have a warning (with apologies to Abraham Lincoln): 'This may be true for some of the people some of the time, but will not be for all of the people all of the time'! Nevertheless, this is a vital area to consider in both research and clinical practice related to language and language impairment.

Is bilingualism bad for you?

In 1923, D.J. Saer, a British school headmaster from Aberystwyth, Wales, claimed that bilingualism was detrimental to intelligence and bilingual children exhibit mental confusion. Thirty years after the study was published, Darcy (1953) reviewed a body of literature and reported that most studies examining the effects of bilingualism on measures of intelligence concluded that bilinguals suffer a 'language handicap' on verbal tests of intelligence. Indisputably, these early studies were poorly controlled on many key methodological factors such as socio-economic status, age and degree of bilingualism (Barac & Bialystok, 2011), nevertheless they created a negative attitude towards bilingualism among educators and general public alike.⁵

It is vital to note that much of this research (both for and against a (dis)advantage) fails to adequately acknowledge and/or control for the fact that bilinguals can differ in many dimensions from monolinguals with whom they are being compared. This includes differences in socio-economic status (in either direction depending on the particular communities; cf Asian migrants to Australia who tend to be of high socio-economic status, and migrant Mexican farm workers in the USA who are usually of low socio-economic status) or educational level (e.g., Massey & Parr, 2012), or that bilingual children may lack proficiency in the dominant community language (the language in which testing is carried out). It is essential that when considering the alleged 'disadvantages' or 'advantages' of bilingualism across the lifespan, clinicians are aware of these potential sources of bias in such research.

The majority of researchers do *not* now hold the view that bilingualism is a disadvantage intellectually or linguistically (Titone et al., 2017), and indeed some argue that bilingualism may confer advantages (e.g., for phonological awareness – awareness that words are composed of individual sounds (e.g., Bialystok, Majumder, & Martin, 2003; Campbell & Sais, 1995); executive function – ability to ignore background or distracting information (e.g., Bialystok, Craik, & Ryan, 2006; Bialystok, Klein, Craik, & Viswanathan, 2004). Nevertheless, Bialystok, Craik, and Luk (2012), amongst others, note that teachers and clinicians continue to advise parents to 'simplify' their children's linguistic environment by using a single language when there are signs of struggle with language or literacy.

Is bilingualism good for you?

Few people these days would contest that being bilingual has a host of benefits across personal, economic, social, and cultural dimensions. However, being bilingual has also been argued to have benefits for cognitive ability. Indeed, it has been suggested that cognitive ability is predicted better by bilingualism than by age, immigration, education or gender (Kavé, Eyal, Shorek, & Cohen-Mansfield, 2008; Mohamed Zied et al., 2004) across the lifespan (Green, 1998). For example, seminal work by Peal and Lambert (1962) demonstrated better performance for bilingual children than monolingual children on measures of verbal and non-verbal intelligence. Peal and Lambert concluded: 'Intellectually [the bilingual child's] experience with two language systems seems to have left him with a mental flexibility, a superiority in concept formation, a more diversified set of mental abilities' (Peal & Lambert, 1962, p. 20). Bialystok et al. (2012) suggest that the description of 'mental flexibility' fits the patterns found in the literature since then, showing that bilinguals have the ability to process information efficiently and adaptively. The source of

this ‘flexibility’ has been argued to originate in the bilingual speaker’s need to ensure that they use the appropriate language for every spoken interaction: They must choose the right words, the right sounds, the right grammar and more.

This requirement for ‘language control’ has been suggested to pose greater demands on selection, inhibition and monitoring than is the case for monolingual speakers (e.g., Green, 1998; Kroll & Bialystok, 2013; Kroll, Bobb, & Hoshino, 2014). This continual ‘practice’ is therefore proposed to result in bilinguals having an advantage in executive control abilities compared to monolinguals. While there is little consensus as to the precise components of executive control, the term is usually used to refer to higher order cognitive abilities that control a range of skills such as selective attention, problem solving, inhibition of irrelevant information, monitoring of goal driven behavioural responses and working memory (e.g., Mackie, Van Dam, & Fan, 2013; see Diamond, 2013 for a review). Tasks used to measure executive function in bilinguals usually involve some form of ignoring of an irrelevant piece of information or resolution of conflict when making a decision. For example in the Stroop task (Stroop, 1935), a colour word (e.g., RED) is written in either the same colour as its name (red) or a different colour (blue). The participant’s task is to name the colour of the ink and the researcher examines whether there is a difference between how fast colour naming is when the word and the ink colour are the same (congruent) or different (incongruent). Other tasks, where once again the key element is whether congruent and incongruent stimuli differ in speed and/or accuracy, involve, for example, arrows distracting the participant to the correct direction of the target (Flanker task, Eriksen & Eriksen, 1974), or response keys being on the same side or different side as the target (Simon task: Simon & Berbaum, 1990; Simon & Small, 1969; Simon & Wolf, 1963).

Strong claims have been made for a bilingual advantage in non-linguistic cognition on the basis of this literature. This is clearly summarised by Bialystok and colleagues, who observed that ‘... studies of executive function demonstrate a bilingual advantage, with bilinguals outperforming their monolingual counterparts on tasks that required ignoring irrelevant information, task switching, and resolving conflict’ (Kroll & Bialystok, 2013, p. 2; see also Bialystok et al., 2012). For example, Bialystok et al. (2004) reported the first study of a bilingual advantage (often explored in children) in older adults. They showed that older adult bilinguals were not only faster on the Simon task than monolinguals, but also showed relatively less interference from the incongruent condition, even though they were matched for educational and socio-economic status (although they did not share a culture: bilinguals from India and monolinguals from Canada).

More recently, strong counter claims have been made. These can be summed up by the titles of papers by Paap, Johnson, and Sawi (2015) ‘Bilingual advantages in executive functioning either do not exist or are restricted to very specific and undetermined circumstances’ or Goldsmith and Morton (2018) ‘Time to disengage from the bilingual advantage hypothesis’. Critically, several studies have been unable to replicate the positive effects (e.g., Kousaie & Phillips, 2012; Morton & Harper, 2007; Paap & Greenberg, 2013; also see Hilchey & Klein, 2011; Valian, 2015 for reviews). Studies reporting a bilingual advantage have been criticised for poor methodological design, not adequately controlling for demographic variables such as education level or socio-economic status, and for confirmation bias (Morton & Harper, 2007; Paap & Liu, 2014; but see Antoniou & Wright, 2017). It has also been argued that bilingual advantages disappear when tested in large number of participants indicating that the effects are either non-existent or exist only in studies with a reduced sample size (Paap et al., 2015).

Recently, a number of meta-analysis have failed to confirm a robust bilingual advantage, suggesting a publication bias for studies with positive effects (de Bruin, Treccani, & Della Sala, 2015), and have argued that once a publication bias has been corrected for there may be no bilingual advantage (Lehtonen et al., 2018; but see Antoniou & Wright, 2017). Even when bilingual advantages have been demonstrated (i.e., overall faster responding for bilinguals compared to monolinguals), the results often do not show an effect consistent with improved cognitive *control* (e.g., Grundy, Chung-Fat-Yim, Friesen, Mak, & Bialystok, 2017; Nair, Biedermann, & Nickels, 2017): Bilinguals fail to show less of a difference between congruent and incongruent trials than monolinguals, as is predicted if bilinguals have a better ability to inhibit irrelevant or conflicting stimuli. This particular feature of the data is very often lacking in the literature (or appears in some tasks but not all, even within the same study, e.g., Bialystok, Craik, & Luk, 2008).

Such conflicting findings have often resulted in heated exchanges, and reviews have been often criticised for ignoring studies reporting bilingual advantages, selectively reporting findings from younger bilingual adults where the effects are most inconsistent, and dismissing studies that have carefully controlled for demographic variables such as socio-economic status (e.g., Bak, 2015; Titone et al., 2017). Suffice to say, the pattern is complex, and because of the heterogeneity of bilingualism designing the definitive experiment is close to impossible. However, it is not just bilingualism that has been argued to have benefits for cognitive ability, other forms of expertise, such as musicianship, also have been suggested to have benefits (e.g., Bialystok & DePape, 2009).

An important aside at this point relates to the effect of bilingualism on the brain: It is clear that acquiring another language or being bilingual results in a change to the neural organisation of the brain (e.g., Perani & Abutalebi, 2005). It is well attested that the brain has what is known as ‘experience-dependent plasticity’ – neural organisation adapts depending on experience. A well-known example is that of London taxi drivers (who have to memorise every street in Greater London to get a licence) who show structural changes in the hippocampus compared to controls (Maguire et al., 2000). However, it is important to remember that we must be cautious, as a difference at the level of the bilingual brain does not necessarily map onto a behavioural difference (except for the obvious one that another language can be spoken), let alone a behavioural advantage, nor does it inform cognitive theory regarding the cognitive mechanism underpinning any such advantage (e.g., Duñabeitia & Carreiras, 2015).

In sum, it cannot be unambiguously stated that being bilingual is good for your cognitive abilities. However, it is also clear that being bilingual is certainly not cognitively detrimental.

Is bilingualism good for cognition in older adults?

Although, as discussed above, controversies are rife, it seems that bilingual advantages are most consistently reported in older adults. Bialystok et al. (2012) conclude that while bilingualism has a ‘muted’ effect in adulthood, its influence is larger in older adults. They suggest that bilingualism protects against cognitive decline – that it provides ‘cognitive reserve’. Cognitive reserve is defined as the ability to perform a task well by utilising the available brain reserve effectively (Steffener & Stern, 2012; Stern, 2002). Increased cognitive reserve has been associated with factors such as education and literacy, musical abilities, socio-economic status, physical activities, general intelligence and social networking abilities (Steffener & Stern, 2012; Titone et al., 2017). Several facets of cognitive function decline with increasing age (e.g., West, 1996), and those individuals with increased cognitive reserve, from whatever source, appear to show less age-related decline (e.g., Stern, 2002).

Bialystok and other authors have argued that active use of executive control abilities in bilinguals leads to increased cognitive reserve that, in turn, prevents cognitive decline (e.g., Bak, 2016; Baum & Titone, 2014; Bialystok et al., 2004). For example, in a large scale study with 853 participants Bak, Nissan, Allerhand, and Deary (2014) examined the effects of bilingualism on cognitive ageing in Scottish older adults and argued that bilingualism had a significant positive effect on general cognitive abilities, general intelligence and reading. This replicates the findings from earlier studies reporting an advantage in

older bilingual adults compared to monolinguals and a buffer against cognitive ageing (also see Bak, 2016 for review). Bak et al. (2014) also found that speakers of three or more languages showed larger cognitive advantages than speakers of two languages. Kavé et al. (2008) also found that the more languages a person speaks the greater the advantage – multilingual participants (speakers of four or more languages) showed better cognitive ability than bilinguals or trilinguals. Moreover, these effects did not depend on the participants’ literacy or their immigration status, and remained significant even after 90 years of age.

Other studies have failed to show any such benefit (e.g., Zahodne, Schofield, Farrell, Stern, & Manly, 2014), and this has been corroborated in a meta-analysis (Mukadam, Sommerlad, & Livingston, 2017, but for critique see Woumans, Versijpt, Sieben, Santens, & Duyck, 2017). Mukadam, Jichi, Green, and Livingston’s (2018) recent paper has its strength in using a longitudinal design. This allows the change in cognitive function over time to be measured and the rate of this change to be compared between monolinguals and bilinguals. The authors used data from the Australian Longitudinal Study of Ageing (2087 participants aged over 65 tested over 20 years; 111 participants by the final data point), which had the advantage that a large number of additional factors could be examined (e.g., language, cognition, mental health, social networks, physical health). In this study, cognitive decline did not differ between bilinguals (who spoke a different language at home to that of the community) and monolinguals – instead it was years of formal education that was predictive. However, Mukadam et al. remain cautious in their interpretation. While they conclude that simply speaking two languages is not protective, it could be that the pattern of language use in bilingual speakers may be critical. They note that in some studies showing cognitive protection in bilinguals (e.g., Kavé et al., 2008; Perquin et al., 2013), participants are immersed in a multilingual society. They suggest that perhaps more frequent language switching could have a more extensive (and hence more protective) effect on cognition than in those individuals who may restrict the use of languages depending on the environment.

Can bilingualism prevent dementia?

In 2007, in the first of a series of articles, Bialystok and her colleagues reported that being bilingual could delay the onset of dementia by up to five years (Bialystok, Craik, & Freedman, 2007; Chertkow et al., 2010; Craik, Bialystok, & Freedman, 2010). This research sparked considerable interest in both the media and research communities and has continued to be influential. However, since then, once again, the picture has become less clear. A major issue is that of potential

confounds – the protective effect of bilingualism has been suggested to be confounded with immigration status (migrant vs non migrant bilinguals; e.g., Fuller-Thomson & Kuh, 2014) and educational level (e.g., Gollan, Salmon, Montoya, & Galasko, 2011), amongst other potential confounding factors. This is far from trivial as a meta-analysis of factors influencing the onset of dementia concluded that higher levels of education, occupational complexity, and regular engagement in mentally stimulating leisure activities was associated with a 50% reduction in the incidence of dementia (Valenzuela & Sachdev, 2006).

The pattern seems to be that retrospective studies (e.g., looking at the records of individuals referred to memory clinics) are more likely to show evidence of a protective effect of bilingualism for dementia even when confounds with education and immigration are better controlled for (e.g., Alladi et al., 2013; Woumans et al., 2015). However, the majority of *prospective* studies, where cognitively healthy individuals are followed over time have found no protective effect of bilingualism on cognitive decline once potentially confounding factors are controlled (e.g., Zahodne et al., 2014; see Fuller-Thomson, 2015 for a review). The contrast between methodologies is most likely because in prospective studies, individuals are their own controls and so initial cognitive ability can be precisely measured and accounted for in the analysis, which cannot occur in the retrospective studies.

In sum, the jury is still out on whether bilingualism delays the onset of dementia independently from other variables (e.g., Antoniou & Wright, 2017; see also Calvo, García, Manóloff & Ibáñez, 2015 for a critical review) and once again caution is required when claims are made.

Should older adults learn another language?

Antoniou, Gunasekera, and Wong (2013; Antoniou & Wright, 2017) proposed that perhaps learning a foreign language would be beneficial in promoting healthy cognitive function and protection from decline⁶ and the benefits of bilingualism may indeed extend to late bilinguals (e.g., Nair, Biedermann, & Nickels, 2016). However, caution is urged: Those studies that have examined the issue show no clear picture: Bak (2016) found advantages as a result of language learning advantages for task switching while Ramos, Fernández García, Antón, Casaponsa, and Duñabeitia (2017) did not (see also Ware et al., 2017; see Klimova, 2018, for an overview of current studies in this field). Moreover, there is limited evidence that cognitive abilities in older adults benefit from cognitive training more broadly, beyond improvement on the practiced task (see e.g., Simons et al., 2016). Nevertheless, any activity that brings positivity and engagement is to be encouraged in older adults.

Do bilinguals have better language skills?

We have focused so far on the (non-verbal) cognitive skills of bilingual speakers, but what about their language skills – does speaking another language make you a more skilled language user? In terms of usage of any one language, most researchers would agree that bilinguals are, in some ways, less proficient than monolinguals, because of the necessity of managing two languages and having less practice with each than a monolingual (e.g., Bialystok, 2009; Kroll & Gollan, 2014). However, bilinguals do seem to have better metalinguistic skills, including for example, phonological (e.g., Campbell & Sais, 1995), morphological (e.g., Bialystok & Barac, 2012), grammatical awareness (e.g., Galambos & Goldin-Meadow, 1990) and word learning (Kaushanskaya & Marian, 2009).

Fluent bilinguals are known to show some degree of activation of both languages and some interaction between the languages at all times (e.g., Spivey & Marian, 1999). Even in contexts where only one language is suitable – they simply cannot just ‘turn off’ one of the languages (e.g., Kroll, Bobb, & Wodniecka, 2006). As discussed above, some authors argue that this leads to benefits for cognitive processing (e.g., Bialystok et al., 2012). For language processing, this activation of both languages might be expected to cause problems, although we should not forget that every speaker has some degree of competition, for example between registers (formal, colloquial, child-directed) or in their word choice (basic, subordinate or individual; e.g., dog vs collie vs Lassie). Nevertheless, for the bilingual, some authors suggest that the additional constraints of language choice and greater lexical choice have been suggested to be the source of linguistic costs (Costa & Santesteban, 2004; Gollan, Montoya, Cera, & Sandoval, 2008).

For example, bilinguals name pictures more slowly than monolinguals (e.g., Bialystok et al., 2008; Costa & Santesteban, 2004; Gollan, Montoya, Fennema-Notestine, & Morris, 2005) and less accurately (e.g., Roberts, Garcia, Desrochers, & Hernandez, 2002). This is often attributed to the fact that bilingual speakers have reduced use of words in each language (frequency lag; e.g., Gollan et al., 2008; Gollan et al., 2011) – they speak each language less than monolinguals who speak it all of the time. Consequently, words are relatively lower frequency in the bilingual lexicon and, given the well attested effect of frequency on word retrieval, therefore, retrieved slower and less accurately. This account is supported by the fact that although bilinguals are more likely to have a tip-of-the-tongue (TOT) state, they perform similarly to monolinguals if credit is given for a name being produced either language (Gollan & Silverberg, 2001). Bilinguals also produce fewer words in category generation (especially semantic categories; e.g., Gollan, Montoya,

& Werner, 2002; Rosselli et al., 2000), even if responses can be provided in either language (de Picciotto & Friedland, 2001; Gollan et al., 2002).

So, to summarise there seems to be some linguistic cost for the bilingual speaker, but this is almost entirely attributable to the inevitability of reduced time spent speaking each language.

Does bilingual language change with ageing?

Although language is relatively stable with ageing compared to many other aspects of cognition, both bilinguals and monolinguals show a generalised slowing in speech production, reduced verbal fluency and a high number of tip-of-the-tongue states with age – suggesting problems in lexical and phonological retrieval (Bialystok et al., 2008; Burke & Shafto, 2008; Burke, MacKay, Worthley, & Wade, 1991). However, it may not be the case that older bilinguals are always more affected. For example, Gollan and colleagues have found that older bilinguals retrieve low frequency words in their non-dominant language more easily than would be expected given their ability to retrieve higher frequency words (Gollan et al., 2008). The authors explain this by suggesting that this can be accounted for by an amelioration of the effect of frequency found in younger bilinguals – older bilinguals have simply used these words for longer than younger bilinguals and therefore increased their frequency and hence their accessibility.

Language switching

When bilinguals converse with other bilinguals, they have the flexibility to choose the language in which to converse, and, moreover, commonly switch between languages (known as language switching or code switching; see e.g., Chan, 2008; Myers-Scotton, 2006, for review). Language switching does not only occur in spoken language but can also occur in informal writing such as emails and texts (Bautista, 2004). While occasionally switching may reflect relative lack of proficiency in a language, or the fact that a lexical item is only known in one language, it is important to understand that switching is more often a reflection of speakers being highly proficient in both languages (e.g., Poplack, 1980; Toribio, 2001).

Whether or not bilingual speakers switch is governed by a complex set of constraints such as length of language contact in the community, roles and status of each language, and speakers' relative proficiency in each (Bentahila & Davies, 1995). Bentahila and Davies also contrast conventionalised 'community' patterns of switching and individual 'invented' switching patterns. Furthermore, it is not that switching is random. There are clear structural and grammatical

constraints governing at what point within a sentence (or even within a word) switching can occur (e.g., Miller Amberber, 2012; Myers-Scotton, 1998).

While some studies have found that older adults find language switching more difficult than young adults (Gollan & Ferreira, 2009; Hernandez & Kohnert, 1999, 2015; Weissberger, Wierenga, Bondi, & Gollan, 2012), Gollan and Ferreira (2009) found that when aging bilinguals were allowed to voluntarily choose which language to use to name pictures, aging-related switching difficulties were limited, and older adults chose to switch as often as young bilinguals.

Language attrition

As noted above, it is now recognised that the constant interaction between languages in a bilingual's mind inevitably causes changes to those languages (Schmid, 2013; Schmid & Köpke, 2007; Weinreich, 1968). In attrition, the first language (L1) appears to become less easily accessible, and word-finding difficulties, intrusions from the second language (L2), and lexical and grammatical errors may begin to occur in L1 (Schmid & Keijzer, 2009). Schmid and Köpke (2017) suggest that there could be two mechanisms at play: a (long-term) deterioration of the L1 representations, and/or increased processing difficulties in L1 (in comprehension, production, etc), as a consequence of co-activation of L2. However, L1 attrition does not seem to be a linear trend over a lifetime: it is not the case that L1 abilities progressively decrease as L2 becomes more and more dominant. A commonly held view is that older adult bilinguals have a worsening in their second language skills and their first language improves (language reversion, e.g., De Bot & Clyne, 1989; Schmid & Keijzer, 2009). However, this pattern does not seem to be as systematic as is widely believed, and not much is known about the underlying processes and causes of any language reversion that may occur.

Schmid and Keijzer (2009) found that, in a group of immigrants (aged from mid forties to late seventies), those who were the most affected by attrition in their first language were around or just past retirement phase (age 68–71), and that subsequently attrition was not as strong (indeed those aged over 72 performed better than those aged 68–71 on every measure). Schmid & Keijzer argue that there was, therefore, support for some degree of 'reversion' at least in terms of a reduction in first language attrition. They suggest that perhaps environmental factors may be at play, including, for example, more exposure to, and use of, L1 in the home environment rather than the work environment following retirement. This could perhaps be in combination with increased personal motivation for the use of L1, including experiencing (self-reported) nostalgia, a longing for the 'old'

country. However, Schmid and Keijzer (2009) also suggested that sampling issues may be at play – those adults able to participate in this cross-sectional study after the age of 72 will be those with better physical health, and therefore better cognitive abilities, who may have been less affected by attrition.

In contrast to Schmid and Keijzer's focus on L1, De Bot and Clyne (1989) examined L2 and also noted that social circumstances promoted language reversion for L2 in healthily ageing bilinguals. However, this mainly applied to those with low L2 proficiency who therefore only used their second language in a limited number of settings, such as in shops or restaurants. It was these individuals who were more likely to show language reversion in terms of reduction in L2 ability.

In sum, some older adults may indeed show improved performance in their first language, and others a reduction of skill in their second language. However, this 'reversion' seems to be neither inevitable, nor common – hence its designation as a 'myth' (Schmid & Keijzer, 2009).

Bilingualism and language impairment in older adults

With ageing comes a higher incidence of acquired language disorder as a result of brain damage – either acutely through, for example, stroke, or in degenerative disorders such as dementia (including atypical dementias where language is the primary symptom – Primary Progressive Aphasia, Gorno-Tempini et al., 2011).

Bilingualism and dementia

In line with the prevalence of the idea of reversion in healthily ageing bilinguals, it is commonly assumed that in individuals with dementia there is regression to the language that is both first-learned and dominant (Ardila & Ramos, 2008). Mendez, Perryman, Pontón, and Cummings (1999) provide a typical example. In their study, caregivers of a group of 51 people with dementia (of various types) reported decreased conversation in L2, a greater preference for the patients' original languages, intrusions from L1 into L2 conversational speech and asymmetrical language impairment with preferential preservation and use of L1. Many recent experimental cross-sectional studies have also found that the non-dominant language is more affected (see Calabria et al., 2017, Table 1).

However, other reports suggest that the pattern is not uniform. For example, Manchon et al. (2015) found that a group of 13 late proficient bilinguals with Alzheimer's type dementia were equally impaired relative to matched controls in both of their languages

suggesting parallel decline. Gollan, Salmon, Montoya, and da Pena (2010) found the same pattern of parallel decline in balanced bilinguals (see also Calabria et al., 2017; Costa et al., 2012; and, for comprehension, Nanchen et al., 2017). However, when Gollan et al. looked at bilinguals with one clearly more proficient language and early Alzheimer's disease, they found that, surprisingly, these individuals showed greater relative impairment in retrieving names in the dominant language than their non-dominant language. Gollan et al. suggested that perhaps this was not as counterintuitive as it at first appeared: the words that are hardest for a speaker to retrieve are those of lowest frequency and for bilinguals these very low frequency words will most probably belong to their dominant language (they simply won't ever have acquired them in their other language). Consequently, given that the first words that are affected in dementia are the least frequent, then the effects of dementia will be most apparent (relative to bilingual controls) for the low frequency words that are only known in the dominant language. Importantly, when Ivanova, Salmon, and Gollan (2014) followed up these unbalanced bilingual speakers over time, the non-dominant language seemed to decline more steeply than the dominant language. Ivanova et al. suggest that rather than decline being a function of language, it instead reflected the robustness of the representation of specific lexical items – those items that are least securely represented will be lost first. Crucially, however, they point out that it is not the case that lexical items in the non-dominant language are all less robustly represented than those in the dominant language, but that there is a gradient both within and across languages. This results in the pattern where the lowest frequency words from the dominant language may be the most vulnerable to the effects of dementia, but the highest frequency words from this language may be the least vulnerable.

Finally, in an interesting study, Gollan, Stasenko, Li, and Salmon (2017) examined reading of paragraphs (written mostly in one language, but containing a few words from the other language) by bilingual speakers with Alzheimer's disease. Both the individuals with dementia and bilingual controls had more difficulty with reading in the non-dominant language. Moreover, the individuals with dementia produced more intrusions (and self-corrected less often) than the control participants. However, there was no consistent evidence to suggest that this difficulty was greater for the non-dominant language. Gollan et al. suggest that this provides clear evidence that individuals with Alzheimer's disease have intact ability to select a default language (with contextual support) and to switch languages, but an impaired ability to monitor language membership in this context.

In sum, for language decline in bilingual speakers with dementia, there is, once again, a mixed pattern. However, overall, given the less robust representation of the non-dominant language, over time it appears likely that most people with dementia will retain stronger linguistic abilities in their dominant (usually first) language. The consequences of this change to language abilities can be dramatic. For example, Tipping and Whiteside (2015) report how this creates challenges for family members, particularly if they do not share the person's better preserved language. This raises the importance of multilingual community-based aged care services being available to offer support. However, as Tipping and Whiteside note, there may be barriers from negative past experiences, lack of communication, stigma, cultural understanding, and locality that need to be overcome.

Bilingualism and aphasia

When other factors are controlled, the frequency of aphasia post-stroke does not appear to differ between bilingual and monolingual speakers (Alladi et al., 2016). However, once again, there is debate as to whether the severity of the aphasia differs between bilingual and monolingual populations. For example, Penn, Frankel, Watermeyer, and Russell (2010) argued that bilingual speakers with aphasia demonstrated superior conversational skills, and Paplikar et al. (2018) found that aphasia seemed to be less severe in bilingual speakers than monolingual speakers in an (Indian) non-migrant sample. In contrast, Hope et al. (2015) reported that bilingual (immigrant) non-native English speakers with aphasia performed more poorly on a range of language tasks administered both in English (which is probably unsurprising) and in their native language compared to monolinguals.

Recovery patterns

Much of the early research on bilingual aphasia focused on the study of recovery patterns (e.g., Obler & Park, 2012). As a general rule, the type of aphasia is the same in both languages, and degree of impairment is proportional to the degree of proficiency pre-aphasia (e.g., Green & 2005; Paradis, 2001). Parallel recovery is experienced by between 40% (Fabbro, 1999) and 70% (Paradis, 2001) of bilinguals with aphasia. However, there are many exceptions: Fabbro (1999) cited 32% of individuals reporting better recovery of L1, and 28% with better recovery of L2 (Fabbro, 1999). For example, EM (Aglioti, Beltramello, Girardi, & Fabbro, 1996) selectively recovered L2 (standard Italian) while losing L1 (Venetian).

Factors that have been evoked as promoting differential recovery include, first language versus second language (Ribot, 1881), most used versus least used language (Pitres, 1895), emotional ties with each

language (Krapf, 1955; Minkowski, 1963), usefulness of the language following the cerebral insult (Bay, 1964). However, none of these seem to explain differential recovery patterns completely. A more sophisticated specification of recovery patterns comes from Green and Abutalebi (2008). They suggest that selective recovery results from impaired control mechanisms or the inability to activate a language; parallel recovery from similar levels of inhibition of both L1 and L2; finally, alternating antagonistic recovery (where improvement in one language is paralleled by inaccessibility of the other, and then the pattern switches), was argued to be due to the inhibition of one language followed by a shift in inhibition to the other language.

It is also important to note that what may appear to be differential impairment in each language may in fact be a consequence of the differences between those languages. For example, cross-language differences in word frequency, orthographic rules, word structure complexity and syntax may result in the occurrence of specific errors in each language (Paradis, 2001).

Language switching in aphasia

There has been relatively little attention paid to language switching (code switching) in people with aphasia. As noted above, language switching itself is not a sign of lack of proficiency, consequently language switching in a person with aphasia should not immediately be considered to be a sign of impairment. Nevertheless, there are descriptions of individuals who show inappropriate and involuntary language switching following aphasia (e.g., language switching with monolingual speakers: Fabbro, Skrap, & Aglioti, 2000). However, it is of note that Muñoz, Marquardt, and Copeland (1999) found that bilingual speakers *without* aphasia also switched inappropriately with monolingual speakers. Grammatical impairment in within-sentence language switching (also known as language mixing), where switching occurs at points considered ungrammatical within a sentence, has received even less attention.

It is hard to be sure of the prevalence of 'pathological' language switching in aphasia, as many reports of bilingual aphasia do not mention the extent to which the person with aphasia uses language switching and how far this has changed post-stroke. It seems probable, however, that in these individuals, pathological language switching does not occur, suggesting that this pattern is not common. When it does occur it has been suggested to be more common when related to the degree of language similarity, and premorbid patterns of language use (e.g., Goral, Levy, Obler, & Cohen, 2006). Several authors have also suggested a link between language control (and pathological language switching) and broader impairments of cognitive control (e.g., Keane & Kiran, 2015; Kong,

Abutalebi, Lam, & Weekes, 2014) and damage to sub-cortical networks (e.g., Abutalebi, Miozzo, & Cappa, 2000).

Importantly, a bilingual speaker with aphasia may use intact skills, or available lexical items, in either language in the face of language breakdown. Consequently language switching may be a conscious or unconscious strategy used by the bilingual with aphasia to maximise communicative effectiveness to access the correct word in either language. Critically, language switching is an important part of communication for bilingual speakers. Consequently, the extent to which these patterns have reduced as well as increased need to be considered when investigating the language of bilingual speakers with aphasia.

Bilingualism and primary progressive aphasia

Primary Progressive Aphasia (PPA; Gorno-Tempini et al., 2011) is an atypical dementia where language is the primary symptom, at least early in the disease process. There has been increasing attention paid to the clinical management of this disorder (for an overview, see e.g., Nickels & Croot, 2014, 2015). However, there has relatively little attention to whether there are particular considerations that hold for bilinguals who have PPA. Of the limited reported studies, as for post-stroke aphasia there are a variety of patterns reported: For example, similar decline in both languages (Gómez-Ruiz, Ávila, Bello, Maho, & Espasa, 2007), impairment in 'L2' (Druks & Weekes, 2010; Filley et al., 2006; Hernández et al., 2008; Machado, Rodrigues, Simões, Santana, & Soares-Fernandes, 2010; Zanini, Angeli, & Tavano, 2011) and impairment in the least used language (Filley et al., 2006; Friedman et al., 2010). Due to the limited number of cases (many of which are conference abstracts with limited information), it is not possible to determine whether bilingual speakers appear to be diagnosed with PPA later than monolingual speakers with PPA. However, investigating whether bilingualism is preventative of PPA will be plagued with the same issues as investigating this in other types of dementia (confounds with other factors) and bilingual research in general (what determines L1 and L2) as discussed earlier in this manuscript.

Given the limited information in the literature, clinicians are best advised to apply what is known from post-stroke aphasia and dementia to the bilingual individual with PPA while being mindful of the ways in which the different nature of the disorder will impact on presentation.

Considerations for clinical management of bilingual aphasia

First and foremost, it is vital for the clinician to acquire a detailed view of premorbid proficiency, to avoid attributing to aphasia what is in fact the result of pre-

morbid bilingual features (Kiran & Tuchtenhagen, 2005). A certain 'minimum' proficiency level is not required for a person to be considered bilingual (Muñoz & Marquardt, 2003). Moreover, being a bilingual does not imply knowing how to read / write in both languages (Nair et al., 2017).

As has been noted above, the dominant language does not need to be the one with highest proficiency, and bilingual competence is dynamic: patterns of language exposure can change radically over time. For example, after a stroke, the individual may retire from the workforce and hence be less exposed to the language of the community and more to the home language. This means that changes in language availability might not (or not only) be a direct result of brain damage.

It is also important for the clinician to be mindful that being fluent/proficient in a language does not necessarily imply that there will be, for example, native speaker-like grammar. Crucially, even the early bilingual is not two monolinguals in one (cf Grosjean, 1989): both the interaction between languages and language attrition causes systematic changes in an unimpaired bilingual's languages.

Assessment considerations – Context: It is also important to be aware of the influence of the context on the bilingual speaker's use of language. If the clinician is also bilingual in both of the bilingual with aphasia's languages, this, perhaps surprisingly, may not be ideal for assessment of aphasia in each language independently: If the bilingual with aphasia is aware of the clinician's bilingual status, it might promote greater use of language switching, with a preference for the most easily accessible language. Ideally, for assessment of each language, the bilingual with aphasia should be in a monolingual context.

Assessment considerations – Linguistic & cultural equivalence of tests: Mere direct translation of standardised aphasia tests (perhaps using an interpreter) is often not appropriate. To give a, perhaps obvious, example, in the case of a phonological discrimination task, distinguishing between bat, mat, fat, bad in English would translate into French as chauve-souris, paillason, gras, mauvais, defeating the purpose of the assessment. It is important to have assessments that are directly comparable across languages. The Bilingual Aphasia Test aims to do just this (Paradis & Libben, 1987, available online: <https://www.mcgill.ca/linguistics/research/bat#ebat>), but note that even so, equivalence of item difficulty cannot be assured, making exact comparison of degree of impairment across languages imprecise.

Moreover, cultural differences may mean that even within the same language, assessments might have different degrees of difficulty depending on the dialect. For example, the Boston Naming Test (Kaplan, Goodglass, & Weintraub, 2001) has a cultural bias

with lower accuracy in New Zealand speakers compared to American (Barker-Collo, 2001). Similarly, with the Spanish version of Boston Naming Test, it has been suggested that item order should be changed to reflect the different item difficulty in Spanish compared to English (Allegrì et al., 1997).

Treatment

Traditionally, intervention plans have all too often excluded one language (Green &, 2005; Paradis, 2001, 2004), with some authors suggesting that treating several languages at the same time might inhibit language recovery in general (e.g., Hilton, 1980; Lebrun, 1988; cited in Marangolo, Rizzi, Peran, Piras, & Sabatini, 2009; Wald, 1961; cited in Adrover-Roig, Marcotte, Scherer, & Ansaldo, 2012). All too often, language therapy is offered only in the language of the hospital, for practical reasons (Köpke & Prod'homme, 2009). It has also been suggested that (if feasible) clinicians choose to treat the language(s) that is (are) the most useful at that point in time for the individual to meet their goals (Gray, 2017). However, more recently some authors have suggested that treatment should exploit the fact that the bilingual language system comprises two language codes in one system with cross-linguistic links at the lexical, morphosyntactic and discourse levels (e.g., Adrover-Roig et al., 2012), and therefore treat in both languages. Adrover-Roig et al. (2012) go as far as to say that focusing on a single language of a bilingual with aphasia could be thought of as analogous to forcing a monolingual with aphasia to inhibit some aspects of language, in order to improve others.

This view is rooted in the belief that there may be transfer of therapy benefits from a treated to an untreated language (cross-language generalisation). While the assumption that language representations overlap across languages is consistent with the prediction that treating one language will benefit another, non-treated language, findings from treatment studies in bilingual aphasia do not systematically show such transfer (For an overview, see Table 1, Miller-Amberber, 2012; see also Ansaldo & Saidi, 2014; Farooqi-Shah, Frymark, Mullen, & Wang, 2010). For example, Meinzer, Streiftau, and Rockstroh (2007) and Miller-Amberber (2012) found no transfer from L2 to L1, and Croft, Marshall, Pring, and Hardwick (2011) no transfer from L1 to L2. It is important to note that this mirrors the pattern in monolingual aphasia where generalisation is the exception rather than the norm.

Factors that may influence cross-language transfer include the relative proficiency of treated vs untreated language: One theory of bilingual language processing, the Revised Hierarchical Model (Kroll & Stewart, 1994), has been used to predict more transfer from the weaker to the stronger language (e.g., Edmonds & Kiran, 2006). This is because, in this (translation-

based) theory a weaker language is accessed via a more proficient language. Indeed some studies do show this pattern of transfer from weaker to stronger language (Edmonds & Kiran, 2006; Goral, Rosas, Conner, Maul, & Obler, 2012). However, there are other instances when treating the weaker language appears to lead to stronger inhibition of the more proficient language post treatment (although these effects might be transient and/or restricted to components that were targeted in the treatment; e.g., Abutalebi, Della Rosa, Tettamanti, Green, & Cappa, 2009; Farooqi-Shah et al., 2010; Goral, 2012; Goral, Naghibolhosseini, & Conner, 2013).

It also seems reasonable to assume that areas of similarity between languages may be the best targets for cross-language transfer. For example, stimulation of shared semantic knowledge may activate corresponding phonological representations in both languages and result in improvement of word-finding abilities in both languages (e.g., Ansaldo & Marcotte, 2007; Ansaldo & Saidi, 2014). Similarly, in their review, Farooqi-Shah et al. (2010) observe that transfer in bilingual aphasia treatment is more typically observed when comprehension is targeted rather than production.

At the lexical level, there has been a focus on words that are similar across languages (cognates: e.g., tomato (English)/ tomate (French/-Spanish)). While some authors have claimed cross-language transfer for cognates (e.g., Goral et al., 2012; Kohnert, 2004) others have not (e.g., Hameau & Köpke, 2015: even though lexical transfer was observed from L2 to L1 there was no difference between cognates and non-cognates) and some have even found inhibition for cognates as a result of treatment (Kurland & Falcon, 2011).

In sum, it seems that the factors that explain the occurrence of cross-language transfer are still not fully understood, and, clinicians should be aware that transfer cannot be guaranteed.

Summary & conclusions

Speaking more than one language opens up a world of experiences both linguistic and cultural, and there is no doubt that this benefits the individual and the community and some have asserted that bilingualism is a human right (Simon-Cerejido, 2018). However, in terms of research there have been many claims made regarding the cognitive and linguistic costs and benefits of being bilingual throughout the lifespan and particularly in older age – often on the basis of research that has not sufficiently considered the complexities of the differences between bilingual and monolingual populations.

We do know that bilingual speakers must have differences in their language systems and language skills to monolingual speakers, but perhaps this is

more on a spectrum rather than a divide. This may range from monolingual speakers who have to choose between synonyms and control the speech register (formal, informal, etc.) and make lexical choice dependent on this register, through monolinguals who speak different dialects of a language (e.g., British English vs Australian English) and therefore also have to ensure they control the dialect, to those who may have limited proficiency in a second language (e.g., 'Holiday Italian'), and speakers who are fluent in typologically similar languages to those who are fluent in typologically distinct languages. The skills are the same, but the extent to which there are different lexical and grammatical choices changes along the continuum. There are then further complexities depending on how frequently each language (or dialect or register) is spoken and in what circumstances, and the other cognitive advantages or disadvantages that a speaker may have (given natural variability in these skills).

For researchers and clinicians it is vital to be aware of the heterogeneity of the populations under consideration and read the literature in this light. For clinicians, it is important that they have awareness and understanding of social and political factors such as the status of the individual's other language(s) in the society, the nature of bilingual community of the speaker, language (bilingual/monolingual/formal/informal) mode and interactional context of bilingualism. Similarly, clinicians should not neglect cultural factors in their assessment and treatment of bilinguals with aphasia (Holland & Penn, 1995). Clinicians should also be aware of the potential limitations of their assessment tools, particularly those language and cognitive assessments with monolingual norms (for discussion see Anderson, Saleemi, & Bialystok, 2017). All these considerations are vital in order to ensure that clinicians' treatment and management are optimal for bilingual individuals with language impairment.⁷ It is the responsibility of speech-language pathologists to support and protect bilingual individuals' rights to express themselves in all their languages in accordance with Article 19 of the Universal Declaration of Human Rights (United Nations, 1948).

Although professional organisations such as American Speech, Language and Hearing Association (ASHA) and Speech Pathology Australia (SPA) have position statements and guidelines for working with culturally and linguistically diverse individuals (ASHA, 2017; SPA, 2016), individuals with language impairment remain at risk of receiving speech-language pathology services only in the dominant national language (Simon-Cereijido, 2018). It is hoped that this paper will provide speech-language pathologists some further insights into issues associated with bilingualism and thereby help us move towards better informed services for bilingual speakers.

Notes

1. For conciseness, we will usually refer to speakers of more than one language as 'bilinguals' rather than, the more appropriate, multilingual or bilingual speakers. Unless specifically noted, or a point of contrast in the literature, we include within the scope of 'bilinguals', speakers of two languages and those who speak more than two.
2. Language Proficiency is usually defined as the extent to which a bilingual's skills in one or both of their languages meet age-based native speaker or monolingual expectations. Proficiency has been defined relative to a monolingual speaker's vocabulary size (Bialystok, Luk, Peets, & Yang, 2010) or grammatical skills (Windsor, Kohnert, Loxtercamp, & Kan, 2008).
3. For a very accessible discussion of language attrition see Monika Schmid's website: languageattrition.org.
4. For discussion of how, in clinical setting, to support languages other than the dominant language of the community see, for example, Kohnert, Yim, Nett, Kan, and Duran (2005).
5. Unfortunately, these negative stereotypes are still around today. Consider for example the title of this recent paper 'Multilingualism was associated with lower cognitive outcomes in children who were born very and extremely preterm' (van Veen et al., 2018). Yet the children were compared on a test that would favour monolingual speakers (a Dutch assessment), unsurprisingly those children who spoke only another language at home, performed worse on this Dutch assessment.
6. Strauss (2015) noted that there is no surprise that this has not been done given the difficulty of designing and implementing such a study.
7. See Grosjean (1989) and Abutalebi et al. (2013) for a detailed account of how the social or interactional context of the language community affects bilinguals' language control and cognitive abilities.

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