Dementia in the workplace: Identifying better ways of assessing cognitive functioning.

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Declaration

This thesis contains no material that has been accepted for the award of any other degree or diploma in any University, and, to the best of my knowledge, this thesis contains no materials previously published except where due reference is made.

Michaela Crisp

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A Literature Review

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Abstract

With a push towards self-sufficiency in retirement and staying at work for longer, there is a growing need to be able to anticipate the cognitive capacity of older workers. This review concerns the dangers of dementia associated with continued employment and considers two broader issues within the organisational context: (i) workers may exit the workforce prematurely due to concerns about cognition (ii) workers may stay at work for longer despite cognitive decline. Current measures used to screen for dementia, such as the MMSE, have limited diagnostic value. A new objective measure, the Cambridge Neuropsychological Test Automated Battery (CANTAB), is explored.

Keywords: Retirement, dementia, cognitive functioning, CANTAB, self-evaluation, financial literacy.

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Longevity has become one of modern societies greatest achievements and, as a result, it is inevitable that the number of older workers will increase. Demographic, economic and social changes in Australia have resulted in vastly different patterns of retirement transition from those evident in the past. Retirement no longer necessarily defines as a total and permanent withdrawal from employment, but rather is increasingly viewed as a career transition stage where individuals must psychologically adapt and adjust to retirement life (Shultz & Wang, 2011). There is increasing pressure on older employees to continue working beyond the customary retirement age, with the Australian government encouraging older workers to continue to participate in the workforce to offset the anticipated costs of population aging by changing the concept of the traditional retirement age, and providing older workers with better opportunities for continued employment. Arguably then, the years proceeding retirement encompass many important key considerations and decisions an individual must make in respect to preparing for retirement. However, the increase in older workers has yet to be met with a subsequent decrease of occupational demands, despite the fact that aging may be accompanied by a decline in physical and mental abilities. Further, little attention has been directed to assessing the cognitive ability of older workers to participate in the workforce.

Dementia is one of the most significant public health concerns worldwide and is one of the leading health issues impacting older workers in Australia (Australian Bureau of Statistics [ABS], 2016). The purpose of this paper is to review evidence concerning the dangers of dementia associated with continued employment in the workforce and the need for regular dementia screening programs in the Australian healthcare system. This review is

organised into several sections, with the consequences of an aging workforce covered in the first section and a discussion of the importance of retirement decisions in the second section. The third section provides a brief review of research on dementia, followed by information on self-evaluations, self-rated health assessments, and financial literacy. The final section examines dementia screening methodologies, focusing on the Cambridge Neuropsychological Test Automated Battery (CANTAB) assessment. Organisational Psychologists have the capacity and the responsibility to contribute to the education of people about how and when to retire from the workforce, and a key consideration should be the potential mediating effects of health related concerns, such as a dementia diagnosis.

Consequences of an older workforce

Older employees can be both the most skilled and productive workers, whilst also being the most vulnerable and at-risk. Concerns arise regarding the work-related accidents and illnesses that may occur in workers over the age of 60, particularly in the context of cognitively demanding jobs where workers have the potential to harm others (e.g., colleagues or the public) through their actions in work (Sluiter, 2006). The occupational health and safety (OHS) of older workers is a matter of individual, economic and social concern. Changes in physical and mental capabilities that accompany aging can negatively impact the health and safety of older people at work, and the relationship between aging workers and OHS is complicated. Whilst aging is associated with a general decline in physical health, the relationship with cognition is more complex as not all cognitive processes decline with age. For example, aging is typically accompanied by a decline in the speed and accuracy of perceptual processing; however it is also related to an increase in acquired knowledge and experience (Ilmarinen, 2001). As a result, there is a growing need for employers to be able to anticipate and make the most effective use of the cognitive capacity of older workers.

Dementia in the workplace is associated with a considerable increase in potentially preventable accidents, injuries to self or others, and property damage or loss (Ashford et al., 2006). Thus, workers with undiagnosed dementia are at increased risk of incidences in the workplace and early detection of dementia through cognitive screening could help mitigate these risks.

Retirement

Deciding when & why to retire

Retirement often occurs gradually and individuals may have multiple job exits and re-entries before leaving the workforce. Planning for retirement has become a multidimensional process made intellectually challenging and complicated by a range of factors. During the retirement phase, individuals need to consider their personal and psychological circumstances, including age, family roles, finances, and health; their job and organisational contexts, such as norms, practices, and policies; and broader cultural or environmental aspects such as cultural norms and economic conditions (Moen, Kojola, Kelly, & Karakaya, 2016). Added to this challenge is the significant risk of factors impacting one's decision-making ability. Just as people are beginning to make some of the most complex decisions of their life, they also become more susceptible to problems related to aging, such as dementia, which may significantly compromise their decision-making ability.

Early retirement & consequences of unwarranted early retirement

People may leave the workforce before retirement age due to what is known as 'push and pull' factors (van den Berg, Elders, & Burdorf, 2010). Individuals may be prompted towards early exit from the workforce by negative considerations or 'push factors', such as

poor health, changes in the organisational environment, a lack of job satisfaction, or simply being tired of working. Conversely, ‘pull factors’ are positive considerations that increase an individual’s interest in early retirement, including a desire to spend more time with a spouse or family, more time to spend on hobbies, or the opportunity to engage in voluntary work. An employee’s decision to retire is then determined by the combination of push and pull factors and the context in which they occur (Shultz, Morton, & Weckerle, 1998; van der Berg et al., 2010). Among both retired men and women whose final job was within the last 20 years, the most frequently reported reason for entering retirement was 'reached retirement age/eligible for superannuation/pension' (56%). Interestingly, the second most reported reason for exiting the workforce was 'own sickness, injury or disability' (33%) (ABS, 2016). Previous research has found health to be one of the most consistent and salient single predictors of retirement decision, second only to financial status (Talaga & Beehr, 1989; Taylor & Shore, 1995). Retiring due to health concerns has also been shown to negatively relate to retirement satisfaction (Quick & Moen, 1998), with retirees reporting poorer physical health, and lower activity levels, psychological well-being and cognitive resources (Kim & Moen, 2002; Shultz & Wang, 2011; Zhan, Wang, Liu, & Shultz, 2009). However, exiting the workforce and transitioning into retirement too early without justified reason can have detrimental effects on individual health and wellbeing. ‘Role theory’ provides a general framework for understanding the potential health impacts of early retirement (Ashforth, 2001). The theory emphasises the importance of the work-role identity and role loss in retirement as people transition from worker to retiree and suggests the role change accompanying retirement leads to negative psychological outcomes, such as stress, anxiety, and depression, resulting in low retirement satisfaction (Zhan et al., 2009). What becomes evident from such research is the importance of and ability to regularly assess and monitor individual cognitive functional capacity in relation to continued employment and workforce exit to ensure people are not

needlessly and prematurely exiting the workforce nor remaining in employment when their cognitive functioning is impaired. Current statistics indicate that 185,400 people are retiring too early, the majority of which are women (132,800), and were planning to return to the workforce (ABS, 2016). Thus, it becomes obvious that there is an optimal timeframe in which individuals should exit the workforce to ensure good health and minimise risk, and Organisational Psychologists have an opportunity to help identify and assess critical factors that can help people to do so.

Dementia

Dementia is one of the leading causes of disability and decreased quality of life among Australians over the age of 65. Whilst it is thought to become more common with increasing age and thus primarily affects older cohorts, dementia is not a natural part of aging (WHO, 2017). Within Australia, approximately 413,000 (estimated 2017) people are known to be living with dementia, with projections estimating the number of people affected by dementia to exceed half a million cases by 2025 (Alzheimer's Australia, 2017). The term dementia does not represent a single specific disease, but is an umbrella term that describes a group of symptoms that are associated with a collection of disorders characterised by cognitive impairment and marked functional decline, including deficits in memory, perception, language, personality, and various cognitive skills. The type, severity and pattern development of dementia symptoms varies with the individual and the specific type of dementia; however, onset of the disease is typically gradual, progressive, and irreversible (Alzheimer's Australia, 2017). Currently, there is no treatment to cure or delay dementia progression. However, much can be offered to support and improve the lives of people with dementia, including early diagnosis to promote prompt and optimal management of the condition (WHO, 2017).

Challenges of diagnosing dementia

Diagnosing dementia enables the potential treatment of the disorder and allows patients and their families to better plan for the future, including managing finances, employment routes, and treatment and care options. However, on average, the signs and symptoms of dementia emerge three years prior to a clinical diagnosis of dementia **(**Phillips, Pond & Goode, 2011**)**. During this time, active living requires many important decisions to be made and as such, individual can be adversely impacted by delayed clinical diagnosis. Diagnosing dementia can be difficult for a number of reasons and unfortunately, underdiagnosis of dementia is a common occurrence. Global statistics show that only one in four people with dementia, or fewer, receive a formal diagnosis (Prince, Comas-Herrera, Knapp, Guerchet, & Karagiannidou, 2016). Under-recognition of dementia occurs in 50-80% of all cases (Boustani et al., 2005), with evidence suggesting that medical professional often miss up to 50% of mild to moderate cases of dementia, with detection rates only improving once the disease is in moderately advanced to severe stages (Boustani et al., 2005; Boustani, Watson, Fultz, Perkins, & Druckenbrod, 2003). Potential reasons for delayed diagnoses include physical health problems taking precedence over cognitive difficulties, time constraints to recognition and assessment, and a lack of medical support services, particularly in rural communities (Boise, Camicioli, Morgan, Rose, & Congleton, 1999). There is currently no definitive test for diagnosing dementia. Information from various sources and tests is combined to inform a diagnosis, and the process can be complex and time consuming. Dementia screening is widely unaccepted by older adults due to the stigma associated with a diagnosis, the poor prognosis, and fears of negative financial consequences such as risks to employment, or social consequences such as social isolation (Borson et al., 2013; Boustani et al., 2011; Bunn et al., 2012; Martin et al., 2015; Milne, 2010). Dementia was reported to be the most feared diagnosis in adults aged over 55 and despite evidence that it could improve

case findings, screening for dementia remains controversial (Borson, Scanlan, Watanabe, Tu, & Lessig, 2006; Boustani et al., 2005). All of these factors can consequently have a negative impact on help-seeking behaviours. This becomes particularly problematic when considering older employees in the workplace as unknown or undiagnosed dementia could lead to significant harm to the individual or others, especially in occupational roles where a high level of cognitive functioning is assumed (e.g., medical, legal, or transportation professions). If people are unaware of their declining cognitive state, they may not be capable of making sound judgements regarding exiting the workforce.

Differentiating dementia from depression

Depression presents an additional challenge to the diagnosis of dementia. Depression is one of the most difficult disorders to differentially diagnose from dementia, as it is a common illness among older cohorts and a comorbidity of dementia. Misdiagnosis of dementia as depression often occurs because of a failure to assess cognitive functioning and misperceptions about normal aging (Maynard, 2003). Assessment tools must be able to determine whether discriminant validity is significantly affected by depression (Doniger et al., 2006). Elderly subjects with major depression also perform poorly on tests of memory, as do dementia subjects. Thus, the specificity of tests is particularly crucial in differentiating dementia patients (Égerházi, Berecz, Bartók, & Degrell, 2007). As pen-and-paper neuropsychological assessments are subject to interpretation bias, the discriminant validity of such tests can be compromised by the influence of depressive symptoms (Doniger et al., 2006). Contrastingly, the objectivity of computerise cognitive assessments may make testing more robust to the impact of depressive symptoms. The CANTAB battery has been shown to accurately distinguish mild dementia cases from cases of normal controls and depression (Saunders & Summers, 2010).

Screening for dementia

Pen & paper vs. computerised neuropsychological assessments

Objective data of cognitive and neuropsychological functioning is an important factor for the diagnosis and management of late-life cognitive disorders, such as dementia. Traditionally, objective data of an individual's cognitive functioning was retrieved from pen-and-paper neuropsychological tests. However, with a rapidly growing number of older adults in the population and the rising prevalence of dementia, there is an increasing need for tests that are time and cost efficient, easily and remotely accessible, and require minimal clinician involvement, expertise and resources.

Computerised or automated neuropsychological assessments offer multiple methodological and practical advantages over traditional pen-and-paper neuropsychological tests, including standardised administration and procedures, remote access, limited interaction between participant and examiner, easier data collection through automated scoring and normative comparisons, greater accuracy and precision in response times, reduced floor and ceiling effects, and the ability to assess multiple cognitive domains in one session (Lenehan, Summers, Saunders, Summers, & Vickers, 2016; Wild, Howieson, Webbe, Seelye, & Kaye, 2008). These advantages can be crucial in the early detection of dementia, as well as in extending the range of a test to be sensitive to both mild cognitive impairment (MCI) and the more noticeable changes occurring in early stages of dementia. MCI is a relatively new concept and is typically attributed to people with significant memory loss without other symptoms of dementia, such as behavioural or personality changes (Alzheimer's Australia, 2017).

One of the most commonly applied cognitive tests is the Mini-Mental State Examination (MMSE), which covers cognitive domains such as orientation, attention, and

recall (Folstein, Folstein, & McHugh, 1975). However, opinion is divided regarding how useful the MMSE actually is in diagnosing dementia. The MMSE has a number of known limitations including the length, non-linearity, ceiling effects in very mild disease, and floor effects in non-English speaking groups, or those with little formal education or advanced dementia (Mitchell, 2009). The ideal cut-off thresholds when assessing patients with suspected dementia varies according to age and education and, although recommended scores adjusted by age and education have been published, there is no certainty that these scores are in common use. Whilst it may hold some value in tracking cognitive changes, systematic reviews of the diagnostic accuracy of the MMSE have concluded that it has limited value as a suitable diagnostic tool for dementia as it can often mask dementia symptoms due to learning and education effects (Jacova, Kertesz, Blair, Fisk, & Feldman, 2007; Mitchell, 2009; Tombaugh & McIntyre, 1992). Despite such evidence that the MMSE is insensitive to early cognitive deficits associated with dementia, it is still widely used to aid clinical diagnosis (de Jager, Milwain, & Budge, 2002). The relatively new CANTAB has been positioned as an alternative cognitive assessment measure that addresses the shortcomings of the MMSE in dementia diagnosis.

The Cambridge Neuropsychological Test Automated Battery (CANTAB)

The CANTAB is a computerised neuropsychological assessment battery consisting of a series of interrelated tests measuring psychological functions across three domains: visual memory, visual attention, and working memory and planning, where each domain is represented by several subtests. Originally developed to diagnose dementia in the elderly, CANTAB has been employed in and validated across a wide variety of clinical populations, including psychiatric disorders, neurodegenerative diseases, neurosurgical cases, and acquired pathology (Levaux et al., 2007). It has been studied in specific disease cohorts

including dementia (e.g., Sahakian et al., 1993), Alzheimer's disease (e.g., Sahakian et al., 1988), Parkinson's disease (e.g., Owen, Roberts, Hodges, & Robbins, 1993), and Huntington's disease (Lange, Sahakian, Quinn, Marsden, & Robbins, 1995), and used to characterise the cognitive features of schizophrenia (e.g., Levaux et al., 2007) and depression (e.g., Elliott et al., 1996). The battery has been shown to be sensitive to age-related decline, intellectual deterioration and the early effects of dementia (Robbins et al., 1994; 1998; Sahakian et al., 1988; 1993). The subtests have been standardised and validated on an extensive population aged from 4 to 90 years and possess acceptable to high levels of test-retest reliability and concurrent validity (Fowler, Saling, Conway, Semple, & Louis, 2002), with strong support for the construct validity of CANTAB as a tool for the assessment of brain-behaviour relations (Luciana & Nelson, 2002).

CANTAB system and battery strengths

The CANTAB battery has multiple strengths as an assessment tool. One of the main advantages is the highly standardised administration and testing procedure. After a short training, personnel without a neuropsychological background can administer the test. The flexible nature of the battery allows administrators to create their own battery of subtasks to assess the cognitive area of interest (Torgersen, Flaatten, Engelsen, & Gramstad, 2012). The graded nature of the tests allows for the assessment of a wide range of ability whilst avoiding ceiling effects in normal cohorts and floor effects in impaired elderly subjects (Levaux et al., 2007). All tests are non-verbal, consisting of simple shapes or geometric designs. As such, the tests can be administered cross-culturally and language proficiency is only necessary to understand the instructions prior to task initiation, which are currently available in over 30 languages (Luciana & Nelson, 2002). The automatic data collection allows for immediate feedback of results, whilst eliminating the risk of human error and allowing greater accuracy

in latency and reaction time measurements to provide a detailed indication of a subject's performance. The test battery is administered using a computer and touch-sensitive monitor making it visually attractive and interesting to use, and the game-like quality maintains respondent motivation and engagement (Levaux et al., 2007). The system has been shown to be well tolerated by elderly subjects who generally prefer it to standard pen-and-paper measures (Fowler et al., 2002).

CANTAB subtests

The most common first indicator of subsequent dementia in the elderly is isolated memory impairment. Other contributing factors include decline in working memory, executive function, and visual acuity (de Jager, Milwain, & Budge, 2002). Three subtests are currently available via the CANTAB web-based format that allows subjects to be tested remotely. The Paired Associates Learning (PAL), the Spatial Working Memory (SWM), and the Rapid Visual Processing (RVP) are the most widely used CANTAB tests and together provide a highly sensitive measure of the domains of visual episodic memory, working memory, and sustained attention; deficits in which can be early indicators of cognitive decline and subsequent dementia.

The PAL test assesses episodic memory, visual memory and learning ability (Cambridge Cognition Ltd., 2012). The task involves the ability to associate a stimulus (*what*) with a spatial location (*where*), and contains aspects of both a delayed response procedure and a conditional learning task (Fowler et al., 2002). Respondents are required to recall the spatial location of a predetermined number of unique patterns within a display matrix. The PAL shows strong specificity and sensitivity superior to that of the MMSE (O'Connell et al., 2004). Previous research has shown that the subtest is sensitive to early dementia, where performance on the PAL identified the onset of progressive memory

deterioration in a subgroup of potential dementia subjects (Fowler et al., 1997; 2002). The PAL was more sensitive to decline among potential dementia patients than were traditional measures such as the WAIS-R and WMS-R, with a 6-month decline in PAL performance predicting later progression to Alzheimer's disease (AD) (Fowler et al., 1997; 2002). Égerházi et al. (2007) found AD and MCI patients had significantly impaired performance on the PAL, suggesting that the impaired PAL performance can serve as an indication for preclinical AD, and therefore could be a useful tool to detect dementia. Other research found PAL performance to classify individuals as belonging to either a dementia or a combined depression/control group with 98% accuracy (Swainson et al., 2001). In all of these instances, the researchers concluded that the PAL subtest can serve as a marker for preclinical dementia, and is therefore a useful tool to detect the development of the disorder.

The SWM test assesses the ability to retain spatial information and manipulate remembered items in working memory, which are components of executive function (Cambridge Cognition Ltd., 2012). Executive functions play a crucial role in the ability to generate and execute goal-directed, purposeful behaviour in response to the environment. Executive skills have been shown to be particularly sensitive to cognitive decline (De Luca et al., 2003). Participants must locate a certain number of 'tokens' hidden in boxes. Errors result when the participant re-searches a box. Previous research has found patients with MCI and AD displayed dysfunctions in the SWM task, suggesting impairment of their working memory (Owen et al., 1993).

The RVP test assesses visual sustained attention and processing speed (Cambridge Cognition Ltd., 2012). In this task, participants must indicate when they detect a predetermined target sequence. Whilst it is primarily a test of visual sustained attention, it also requires both working memory and selective attention for successful execution. The impairment of these cognitive domains is well documented in dementia (Jackson & Owsley,

2003; Rizzo, Anderson, Dawson, & Nawrot, 2000). Égerházi et al. (2007) found patients with dementia symptoms to have a significant impairment in the RVP test, indicating the impairment of sustained attention.

CANTAB limitations

There remains some scepticism around computerised testing. Whilst research supports the ability and application of the test battery to discriminate between normal functioning and clinical groups, there remains a lack of research examining the relationship between conventional neuropsychological assessments and CANTAB. As such, it can be difficult to produce an interpretation of results in line with traditional neuropsychological concepts, models, and theories (Leneham et al., 2016; Levaux et al., 2007). Caution also needs to be taken when using computerised instruments where dementia is suspected and when the participant is elderly because of the unfamiliar nature of the person-computer interface and the impact that technology in general has on aged people (Wild et al., 2008).

Self-evaluations

Accurate assessment is important because people are generally not very good judges of their own ability and there may be other psychosocial factors that confound accuracy such as self-efficacy, gender differences and cognitive capability. Self-efficacy refers to one's confidence in their ability to successfully execute a specific behaviour or task and is an important variable in predicting individual behaviour (Bandura, 1977). Self-evaluations of cognitive ability are relevant here as they reflect how individuals think about themselves and misjudgements of abilities can have considerable impacts. For example, consider an individual's career choices: overestimation of cognitive ability may lead to errors in work due to perceptions that one is able to perform better than they actually can. On the other hand,

underestimations of cognitive ability can result in people unnecessarily engaging in self-limiting behaviour if they believe they have a serious cognitive limitation when in reality they do not. Many studies have found self-evaluations to be biased, typically in a positively distorted direction (Freund & Kasten, 2012). Kruger and Dunning (1999) explored why individuals tend to hold overly optimistic and miscalibrated self-views and found individuals with low abilities in various domains have a greater tendency to inflate their self-views and overestimate their true performance and ability. The authors attributed this lack of awareness to a deficit in meta-cognitive skill. Conversely, high performers underestimated their abilities, thus suggesting self-rating accuracy may be mediated by individual intelligence. The study also found that greater exposure to and practice with a particular skillset or test could increase self-evaluation accuracy. However, overall the authors suggest that people are not good judges of their own abilities (Kruger & Dunning, 1999).

Mabe and West (1982) conducted a meta-analysis investigating the relationship between self-evaluated and psychometrically assessed ability measures. Their reported average correlation coefficient of .29 further supports the notion that intelligence is a mediating factor in self-evaluation accuracy as more intelligent subjects evaluated their abilities with greater accuracy than less intelligent individuals. By also investigating the influence of a range of experimental and situational factors, the authors concluded that valid self-evaluations can be expected if (1.) the variable of interest is related to performance; (2.) the estimate is made in reference to a comparison group; and if the individual (3.) is assured of anonymity of their response, (4.) expects a comparison of their self-evaluations to an objective measure, and (5.) has some experience in self-evaluating abilities (Mabe & West, 1982). The authors labelled these factors as ‘favourable measurement conditions’ and suggest these factors need to be present in order to maximise the relationship between self-assessed

and psychometrically measured cognitive ability. Unfortunately, it appears that a lack of insight into decline is a consequence of a decline in cognitive ability itself.

Self-rated health assessments

Whilst there are a number of tools currently available that gauge the presence and severity of dementia symptoms, these are conducted through caregiver observation and report, and are not suited to clinical practice as they are lengthy and/or cover only particular domains (Monahan et al., 2012). Self-report health assessments provide an interesting link between psychology and human biology, and an indication of an individual's level of self-awareness. Self-reports of health are typically generated by gathering relevant information about one's health from various sources, and evaluating this information in relation to a set standard or reference group (Manderbacka & Lundberg, 1996). In the present review of the research literature, no studies were found that have as yet assessed the accuracy of self-report measures of dementia-related symptoms in relation to genuine cognitive functioning. Related research in the field of organisational psychology provides evidence of the accuracy of self-other ratings in leadership. Self-other rating agreement refers to the degree of consistency between a leader's self-ratings and ratings from other sources, such as co-workers (Fleenor, Smither, Atwater, Braddy, & Sturm 2010). Research findings are mixed, with some studies suggesting that individuals tend to inflate their own ratings (e.g., Kruger & Dunning, 1999; Mabe & West, 1982), whilst other research has found individuals provide self-ratings lower than other ratings (Fleenor et al., 2010). However, self-ratings or self-evaluations of ability and performance have generally been shown to be flawed, with most studies reporting only weak to moderate relationships between self-estimates of ability and true ability as measured by psychometric tests (Kruger & Dunning, 1999; Mabe & West, 1982; Ostroff, Atwater, & Feinberg, 2004; Warr & Bourne, 1999).

Gender differences in self-evaluations and self-rated health assessments

Individual and contextual factors such as biographical information and cognitive processes can affect the accuracy of self-perception and consequently self-evaluations, as well as the extent of self-other rating agreement (Atwater & Yammarino, 1992; Fleenor et al., 2010). Studies examining biographical characteristics relative to self-other ratings in leadership research show that males tend to overestimate their abilities and effectiveness relative to other ratings, whilst women typically underestimate their abilities and provide lower self-ratings compared to men (Fleenor et al., 2010). In the health psychology field, various research examining general self-rated health assessments relative to genuine health status yields similar results. Studies have found evidence that gender can affect the outcome of general self-rated health assessments, where women provide lower self-rated health than their male counterparts (e.g., Eriksson, Undén & Elofsson, 2001; Jylhä, Guralnik, Ferrucci, Jokela, & Heikkinen, 1998; McDonough & Walters, 2001; Undén, et al., 2008). In a study on self-rated health and mortality, women self-rated poorer health status than men, which was not reflective of actual mortality rates (Franks, Gold, & Fiscella, 2003). When self-rating health, men and women appear to consider approximately the same broad array of factors; however, women appear to be more attentive to and inclusive of contextual stimuli (Benyamini, Leventhal, & Leventhal, 2000; Undén & Elofsson, 2006). According to social cognitive theory, women tend to underestimate their abilities due to the influence of external information that informs their predictions (Sturm, Taylor, Atwater, & Braddy, 2014). Women appear to be more likely than men to report health-related symptoms that impair quality of life, such as arthritis, and more readily access information and resources regarding physical changes and functionally disruptive conditions (Benyamini et al., 2000). This is consistent with findings from studies examining Australian employees working beyond the traditional retirement age (65 years) that found employed workers with chronic health conditions were

more likely to be males aged 65 to 69 years (McDonald, 2011; Schofield, Callander, Kelly, & Shrestha, 2017).

Financial Literacy

Financial literacy refers to a focused type of individual expertise concerning how to successfully manage one's financial affairs (Fernandes, Lynch, & Netemeyer, 2014). It is used as a measure of "the degree to which one understands key financial concepts and possesses the ability and confidence to manage personal finances through appropriate, short-term decision-making and sound, long-range financial planning, while mindful of life events and changing economic conditions" (Remund, 2010). Financial literacy consists of both a knowledge and application component and can be influenced by factors such as behavioural and cognitive biases, self-control problems, and family, which can subsequently affect financial behaviours and financial well-being (Huston, 2010). Previous research has concluded that financial literacy is an antecedent for various financial behaviours, including efficient planning for retirement (Adams & Rau, 2011). Throughout the literature, both gender and education gaps are evident in financial literacy, where a lack of financial knowledge is concentrated around those with less education, lower socioeconomic backgrounds, and women (Lusardi & Mitchell, 2010). Lower levels of financial literacy among women can have significant implications as women generally live longer than men and have shorter working careers with lower earnings. Research suggests that women are more likely to rely on advice from others when dealing with finances (Lusardi & Mitchell, 2008). A lack of financial literacy can be particularly problematic if women underestimate their financial ability and defer the responsibility to others, leaving them vulnerable when that person is no longer around to initiate or support financial planning. This can have a significant impact on their retirement funds and may be a key deciding factor in determining

when women are able to realistically leave the workforce. As such, financial literacy measures may provide an additional avenue to identify an especially vulnerable group (i.e., women) and monitor the impacts of dementia or cognitive functioning on financial wellbeing.

Conclusion

The benefits of early dementia diagnosis are obvious. Early diagnosis can provide patients and their families the opportunity to plan for the future by maximising their autonomy over decision-making, in addition to allowing patients prompt access to optimal health care and medical management. Avoidance of or delay in the diagnosis of dementia can deprive patients of this degree of self-advocacy in making important life decisions. Early diagnosis may also enhance patient and caregivers' understandings of the impact of modifiable lifestyle factors on the disease process and the effectiveness of interventions such as medication and counselling. In an article by Sackett and colleagues (1991), the authors suggest that it is acceptable to screen for diseases when early treatment is shown to be beneficial; when the screening instrument is acceptable to patients; and when there is sufficient time and resources to provide screening, diagnosis and treatment of a given disorder. The high disease prevalence, associated burden, and substantial economic impact thus suggests that there is a strong need for systematic screening of dementia in Australia. By detecting the disease presence in its early stages through screening, we can decrease the associated burdens of dementia.

Current measures used to screen for dementia, such as the MMSE, have been shown to lack sensitivity to mild degrees of cognitive impairment (Tombaugh & McIntyre, 1992). This project will trial the new, non-intuitive method for assessing cognitive decline, the CANTAB. Brief screening interventions, such as the CANTAB, are useful as they provide information about an individual's cognitive state and require medical professionals to take

minimal additional steps to investigate whether a positive screen is true or false (Ashford et al., 2006). This project will contribute to a gap in current literature by investigating the relationship between people's self-rated cognitive functioning and genuine cognitive functioning through the objective CANTAB ratings. By examining if a relationship exists between the subjective and objective cognitive measures, we can determine whether there is in fact a need to use the CANTAB measure to assess cognitive functioning, or if simple self-evaluations of cognition provide sufficient information at a preliminary diagnosis level. Analyses will be conducted across gender to determine whether gender differences exist in the assessment of dementia symptoms and whether the same cognitive assessments are adequate to use with both males and females.

Policies to improve the employment rates of older workers will only be successful if the key issue of health is addressed. Australians need to be tested for dementia as early as age 45 (Alzheimer's Australia, 2017) and dementia screening needs to become part of people's annual health assessments after the age of approximately 65 years as this is when dementia symptoms become more present on current estimates (Alzheimer's Australia, 2017). Early detection of dementia is important for individual health considerations and to assist people in leaving work correctly. This is a growing concern within Australia and an area where Organisational Psychologists could be providing necessary assistance, including the improvement of dementia screening and identifying critical factors that need to be considered for optimising quality of life in the transition from work to retirement.

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Dementia in the workplace: Identifying better ways of assessing cognitive functioning.

Thesis

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Word limit: maximum 30 pages, excluding reference list and appendices

Abstract

With a push to keep people working for longer, there is a greater need to understand the cognitive capacity of older workers. People may retire prematurely due to concerns about cognition; or stay at work despite cognitive decline and there are important gender differences to consider. This study explores the relationship between self-reported dementia symptoms and genuine cognitive functioning as measured by the Cambridge Neuropsychological Test Automated Battery (CANTAB). Findings suggest that subjective assessments collected cannot substitute for objective assessment. CANTAB may provide a potential gender-neutral solution. Findings have important implications for on-going monitoring of cognitive functioning in the workplace.

Keywords: Retirement, dementia, cognitive functioning, CANTAB, self-evaluation, financial literacy.

Dementia in the workplace: Identifying better ways of assessing cognitive functioning.

Demographic, economic and social changes in Australia have resulted in vastly different patterns of retirement transition from those evident in the past, and are placing increased pressure on older employees to continue working beyond the customary retirement age. Retirement is no longer necessarily defined as a total and permanent withdrawal from employment, but may be viewed as a career transition stage where individuals must psychologically adapt and adjust to retirement life (Shultz & Wang, 2011). However, the need to stay at work for longer has yet to be met with a subsequent decrease of occupational demands, despite the fact that aging may be accompanied by a decline in physical and mental abilities. Further, little attention has been directed towards assessing the cognitive ability of older workers to participate in the workforce and providing workers with relevant feedback. In the absence of feedback people may anticipate a decline when none exists and exit the workplace prematurely. Dementia is one of the leading health concerns impacting older workers in Australia (Australian Bureau of Statistics [ABS], 2016), yet consideration of the disorder in the workplace is minimal. Arguably then, the years proceeding retirement encompass many important key considerations and decisions an individual must make in respect to preparing for retirement. Organisational Psychologists have the capacity and the opportunity to contribute to decision-making about how and when to retire from the workforce, and a key consideration should be the potential mediating effects of health related concerns, such as a dementia diagnosis. In order to understand the consequences of dementia in the workplace, it is necessary to first describe the context of retirement and how misconceptions of cognitive functioning or misdiagnosis of cognitive impairments can determine when individuals exit the workforce. Thus, it is important to have a better

understanding of dementia, how it is assessed, whether people can sufficiently self-diagnose, and whether gender differences exist in self-assessment.

Cognition and older workers: leaving the workforce too early or staying too long?

Older employees may be both the most skilled and productive workers in an organisation, whilst also being the most vulnerable and at-risk. Concerns arise regarding the work-related accidents and illnesses that may occur in older workers, particularly in the context of cognitively demanding jobs where workers have the potential to harm others through their actions (Sluiter, 2006). The relationship between aging workers and occupational health and safety (OHS) is complicated. Whilst aging is associated with a general decline in physical health, the relationship with cognition is more complex as not all cognitive processes decline with age (Ilmarinen, 2001). Dementia in the workplace is associated with a considerable increase in potentially preventable accidents, injuries to self or others, and property damage or loss (Ashford et al., 2006). Workers with unknown or undiagnosed dementia are at increased risk of incidences in the workplace and early detection of dementia through cognitive screening could help mitigate these risks. Self-evaluations of cognitive ability are relevant here as they reflect how individuals think about themselves and misjudgements of abilities can have considerable impacts. For example, in the context of career choices and retirement intentions; overestimation of cognitive ability may lead to errors in work due to perceptions that one is able to perform better than they actually can. On the other hand, underestimations of cognitive ability can result in people unnecessarily engaging in self-limiting behaviour if they believe they have a serious cognitive limitation when in reality they do not, resulting in unnecessary early retirement. Statistics on retirement intentions from the ABS indicate that 185,400 people retired and were then trying to re-enter the workforce with a majority of these being women (132, 800) (ABS, 2016). Other research

shows that it is more difficult for older workers to find employment (NSA, 2017), so these decisions can have lasting consequences. Consequently, there is a growing need for employees to better manage the timing of their retirement and for employers to help support decision-making to optimise workplace exit in terms of individual needs and workforce demands. Accurate diagnosis of dementia-related symptoms can assist by helping to identify optimum exit points.

Making decisions pre-retirement and during retirement

Planning for retirement can be made intellectually challenging and complicated by a range of factors. During the retirement phase, individuals need to consider their personal and psychological circumstances, including age, family, finances, and health; their job and organisational contexts, such as norms and policies; and broader cultural or environmental aspects, such as economic conditions (Moen, Kojola, Kelly, & Karakaya, 2016). Individuals are likely to make significant financial decisions, particularly regarding the management of assets, which can come with additional levels of risk as lost income is unlikely to be replaced. Just as people are beginning to make some of the most complex decisions of their life, they also become more susceptible to problems related to aging, such as dementia, which may significantly compromise their decision-making ability.

Early retirement & consequences of unwarranted early retirement

People may be prompted towards early retirement by negative considerations or ‘push factors’, such as poor health, changes in the organisational environment, or a lack of job satisfaction. Conversely, ‘pull factors’ are positive considerations that increase an individual’s interest in early retirement, including a desire to spend more time with a spouse, family, or on hobbies. The decision to retire is then determined by the combination of push

and pull factors and the context in which they occur (van der Berg, Elders, & Burdorf, 2010). Statistics on retired men and women reveal the most frequently reported reason for retiring was 'reached retirement age/eligible for superannuation/pension' (56%). Interestingly, the second most reported reason for exiting the workforce was 'own sickness, injury or disability' (33%) (ABS, 2016). Previous research has found health to be one of the most consistent and salient single predictors of retirement decision, second only to financial status (Taylor & Shore, 1995).

Exiting the workforce and transitioning into retirement too early without justified reason can have detrimental effects on individual health and wellbeing. 'Role theory' provides a general framework for understanding the potential health impacts of early retirement (Ashforth, 2001). The theory emphasises the importance of the work-role identity and role loss in retirement as people transition from worker to retiree and suggests the role change accompanying retirement leads to negative psychological outcomes, such as stress and depression, resulting in low retirement satisfaction (Zhan, Wang, Liu, & Shultz, 2009). What becomes evident from such research is the importance of and ability to regularly assess and monitor individual cognitive functional capacity in relation to continued employment and workforce exit to ensure people are not needlessly and prematurely exiting the workforce nor remaining in employment when their cognitive functioning is impaired.

Dementia

Dementia is one of the leading causes of disability and decreased quality of life among Australians over the age of 65. The term dementia describes a group of symptoms that are associated with a collection of disorders characterised by cognitive impairment and marked functional decline. Whilst it is thought to become more common with increasing age and thus primarily affects older cohorts, dementia is not a natural part of aging (WHO, 2017).

Currently, there is no treatment to cure or delay dementia progression. However, much can be offered to support and improve the lives of people with dementia, including early diagnosis to promote prompt and optimal management of the condition (WHO, 2017).

Challenges of diagnosing dementia

Routine systematic screening to detect early onset of dementia is one strategy that has been proposed to help combat underdiagnosis of dementia and allow patients and their families to make better-informed decisions whilst the patient is still cognitively aware and able (Phillips, Pond, & Goode, 2011). Avoidance of or delay in the diagnosis of dementia can deprive patients of this degree of self-advocacy in making important life decisions. However, on average, the signs and symptoms of dementia emerge three years prior to a clinical diagnosis of dementia (Phillips, Pond & Good, 2011). During this time, active living requires many important decisions to be made and as such, individual can be adversely impacted by delayed clinical diagnosis. Diagnosing dementia can be difficult for a number of reasons and unfortunately, underdiagnosis of dementia is a common occurrence. Various factors can contribute to underdiagnosis rates, including physical health problems taking precedence over cognitive difficulties, stigma associated with dementia screening, and fears of negative consequences such as risks to employment (Borson et al., 2013; Boustani et al., 2011; Bunn et al., 2012; Milne, 2010). Other major factors impacting delayed diagnoses are constraints to symptom recognition and assessment, and a lack of medical support services, particularly in rural communities (Boise, Camicioli, Morgan, Rose, & Congleton, 1999). These factors can consequently have a negative impact on help-seeking behaviours and becomes particularly problematic when considering older employees in the workplace as unknown or undiagnosed dementia could lead to significant harm to the individual or others. If people are unaware of

their declining cognitive state, they may not be capable of making sound judgements regarding exiting the workforce.

Screening for dementia

The high disease prevalence, associated burden, and substantial economic impact suggests that there is a strong need for systematic screening of dementia in Australia. One of the most commonly applied cognitive tests is the Mini-Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975). Whilst it may hold some value in tracking cognitive changes, systematic reviews of the diagnostic accuracy of the MMSE have concluded that it has limited value as a suitable diagnostic tool for dementia as it can often mask symptoms due to age and education effects (Mitchell, 2009; Tombaugh & McIntyre, 1992). A new assessment, the Cambridge Neuropsychological Test Automated Battery (CANTAB), has been positioned as an alternative measure that addresses the shortcomings of the MMSE in dementia diagnosis. Brief screening interventions, such as the CANTAB, are useful as they provide information about an individual's cognitive state and require medical professionals to take minimal additional steps to investigate whether a positive screen is true or false (Ashford et al., 2006).

The Cambridge Neuropsychological Test Automated Battery (CANTAB)

The CANTAB is a computerised neuropsychological assessment battery consisting of a series of interrelated tests measuring psychological functions across three domains: visual memory, visual attention, and working memory and planning, where each domain is represented by several subtests. Originally developed to diagnose dementia in the elderly, the CANTAB has been employed in and validated across a wide variety of clinical populations and specific disease cohorts including dementia (e.g., Sahakian et al., 1993) and Alzheimer's

disease (e.g., Sahakian et al., 1988). The battery has been shown to accurately distinguish mild dementia cases from cases of normal controls and depression (Saunders & Summers, 2010). Unlike the MMSE, the CANTAB tests are sensitive to age-related decline, intellectual deterioration and the early effects of dementia (Robbins et al., 1994; 1998; Sahakian et al., 1988; 1993). The battery has been standardised and validated on an extensive population aged from 4 to 90 years, with subtests possessing acceptable to high levels of test-retest reliability and concurrent validity (Fowler et al., 2002), and strong support for the construct validity of CANTAB as a tool for the assessment of brain-behaviour relations (Luciana & Nelson, 2002). The system has also been shown to be well tolerated by elderly subjects who generally prefer it to standard pen-and-paper measures (Fowler et al., 2002).

Common initial indicators of subsequent dementia include isolated memory impairment, and declines in working memory, executive function, and visual acuity (de Jager, Milwain, & Budge, 2002). The Paired Associates Learning (PAL), the Spatial Working Memory (SWM), and the Rapid Visual Processing (RVP) are the most widely used CANTAB subtests and together provide a highly sensitive measure of the domains of visual episodic memory, working memory and executive function, and sustained attention; deficits in which can be early indicators of cognitive decline and subsequent dementia (see *Method* section for detailed description of the PAL, SWM, and RVP). The PAL subtest shows strong specificity and sensitivity superior to that of the MMSE (O'Connell et al., 2004). Previous research has shown that the subtest is more sensitive to early dementia than traditional measures such as the WAIS-R, and concluded that PAL performance can serve as a useful marker for preclinical dementia (Égerházi, Berecz, Bartók, & Degrell, 2007; Fowler et al., 2002). The SWM assesses components of executive functions which can be particularly sensitive to cognitive decline and the impairment of which is well documented in dementia literature (Jackson & Owsley, 2003; Rizzo, Anderson, Dawson, & Nawrot, 2000). Research

has found dementia patients display dysfunctions in the SWM task, suggesting impairment of their working memory (Owen, Roberts, Hodges, & Robbins, 1993). Égerházi et al. (2007) found patients with dementia symptoms to have a significant impairment in the RVP test, indicating the impairment of sustained attention.

Self-evaluations & self-rated health assessments

Accurate assessments are important because they inform critical decisions that people make on a daily basis, such as pursuing career options, and inaccurate self-assessments could compromise such decisions. Intuitively, we would expect people to be relatively accurate in their self-evaluations of abilities as we constantly receive feedback on our performance. Research suggests, however, that people are generally not good judges of their own ability, with many studies finding self-evaluations to be biased, typically in a positively distorted direction (Freund & Kasten, 2012). Kruger and Dunning (1999) found individuals with low abilities in various domains have a greater tendency to overestimate their true performance and ability, whilst high performers underestimated their abilities. This suggests self-rating accuracy may be mediated by individual intelligence and results may vary accordingly (Kruger & Dunning, 1999). Mabe and West (1982) conducted a meta-analysis investigating the relationship between self-evaluated and psychometrically assessed ability measures and provided further support for the notion that intelligence may be a mediating factor in self-evaluation accuracy as more intelligent subjects evaluated their abilities with greater accuracy than less intelligent individuals. It may be that a lack of insight into decline is a consequence of a decline in cognitive ability itself. However, Holling and Preckel (2005) argued that people are actually "more successful in estimating their general ability than the correlation between self-estimated and tested intelligence suggests" (p. 503). Thus, the degree of accuracy in self-evaluations remains a matter of debate.

Self-report health assessments provide an interesting link between psychology and human biology, and an indication of an individual's level of self-awareness. No studies were found that have as yet assessed the accuracy of self-report measures of dementia-related symptoms in relation to genuine cognitive functional impairment. Related research in the field of organisational psychology provides evidence of the accuracy of self versus others ratings in leadership (Fleenor, Smither, Atwater, Braddy, & Sturm 2010). Research findings are mixed, with some studies suggesting that individuals tend to inflate their own ratings (e.g., Kruger & Dunning, 1999; Mabe & West, 1982), whilst other research has found individuals provide self-ratings lower than other ratings (Fleenor et al., 2010). Further, people are generally better at rating their abilities or performance on easy and familiar tasks, as opposed to more difficult or unfamiliar tasks for which they do not possess the requisite knowledge (Kruger & Dunning, 1999). However overall, self-ratings or self-evaluations of ability and performance have generally been shown to be flawed, with most studies reporting only weak to moderate relationships between self-estimates of ability and true ability as measured by psychometric tests (Kruger & Dunning, 1999; Mabe & West, 1982; Ostroff, Atwater, & Feinberg, 2004). Confounding this issue further are the potential gender differences that may exist in self-ratings.

Gender differences in self-evaluations and self-rated health assessments

Individual and contextual factors such as biographical information and cognitive processes can affect the accuracy of self-evaluations (Atwater & Yammarino, 1992; Fleenor et al., 2010). Studies examining biographical characteristics relative to self-other ratings in leadership research show that men tend to overestimate their abilities, whilst women typically underestimate their abilities and provide lower self-ratings compared to men (Fleenor et al., 2010). Similarly, in health psychology studies, research examining general self-rated health

assessments relative to genuine health status yields similar results, where women provide lower self-rated health than their male counterparts (e.g., Eriksson, Undén & Elofsson, 2001; McDonough & Walters, 2001; Undén, et al., 2008). According to social cognitive theory, women tend to underestimate their abilities due to the influence of external information that informs their predictions (Sturm, Taylor, Atwater, & Braddy, 2014). Women appear to be more likely than men to report health-related symptoms that impair quality of life, such as arthritis, and more readily access information and resources regarding physical changes and functionally disruptive conditions (Benyamini, Leventhal, & Leventhal, 2000). This is consistent with findings from studies examining Australian employees working beyond the traditional retirement age (65 years) which found employed workers with chronic health conditions were more likely to be males aged 65 to 69 years (McDonald, 2001; Schofield, Callander, Kelly, & Shrestha, 2017). The present study employs the Healthy Aging Brain Care Monitor (HABC; Monahan et al., 2012) as a subjective measure of self-rated dementia symptoms.

Financial Literacy

As indicated earlier, financial risks may be greater for older people due to a lack of replacement income. An individual's financial well-being is partly determined by the capacity for good decision making, but also by financial literacy. Several financial literacy scales are utilised in the present study as secondary measures of self-rated assessments and evaluations. Financial literacy refers to a focused type of individual expertise concerning how to successfully manage one's financial affairs and is used as a measure of the degree to which one understands key financial concepts (Fernandes, Lynch, & Netemeyer, 2014; Remund, 2010). Financial literacy is an antecedent for various financial behaviours, including efficient retirement planning (Adams & Rau, 2011). Throughout the literature, both gender and

education gaps are evident in financial literacy, where a lack of financial knowledge is concentrated around those with less education, lower socioeconomic backgrounds, and women (Lusardi & Mitchell, 2010). Lower levels of financial literacy among women can have significant implications as women generally live longer than men and have shorter working careers with lower earnings. Research suggests that women are more likely to rely on advice from others when dealing with finances (Lusardi & Mitchell, 2008). A lack of financial literacy can be particularly problematic if women underestimate their financial ability and defer the responsibility to others, leaving them vulnerable when that person is no longer around to initiate or support financial planning. This can have a significant impact on their retirement funds and may be a key deciding factor in determining when women are able to realistically leave the workforce. As such, financial literacy measures may provide an additional avenue to identify an especially vulnerable group (i.e., women) and monitor the impacts of dementia or cognitive functioning on financial wellbeing.

The Present Study

To summarise, what is yet to be explored is if the self-report measures of dementia-related symptoms are associated with significant and genuine impairments in cognitive functioning. The present study was designed to investigate alternative ways to assess cognitive functioning. By investigating if a relationship exists between people's self-rated cognitive functioning and genuine cognitive functioning through the objective CANTAB ratings, we can determine whether there is in fact a need to use the CANTAB measure to assess cognitive functioning, or if simple self-evaluations of cognition provide sufficient information at a preliminary diagnosis level. Analyses will be conducted across gender to determine whether gender differences exist in the assessment of dementia symptoms and whether the same cognitive assessments are adequate to use with both men and women. The

long-term goal would be to contribute to facilitating better access to cognitive assessments that can enable improved self-care and monitoring of cognitive functioning and, thus, allow greater control for the individual.

As a preliminary exploratory investigation, the present study posed the following research questions:

Research Question 1. Are there real differences between men and women across measures of cognitive functioning?

a. On the basis of previous research, it is anticipated there will be no gender differences in HABC and CANTAB scores.
b. On the basis of previous research, it is expected that men will score better on financial literacy than women.

Research Question 2. Are people good judges of their own cognition?

a. There will be a relationship between the predicted financial literacy scores and actual financial literacy scores such that men over-estimate scores and women under-estimate scores.
b. There will be no relationship between HABC and objective CANTAB measures. There will be no relationship between financial literacy and CANTAB measures. Subjective measures are not a proxy for objective measures.

Method

Participants and Procedure

This study was funded by National Seniors Australia (NSA) and the data presented are part of a wider study establishing a baseline of cognitive health among Australians aged

55 years and over. Participants were recruited via their membership in one of three organisations: NSA, Seniors Card Australia, and PureProfile platform. An advertisement was placed in e-newsletters inviting members to complete an online questionnaire.

The study comprised of two stages. Stage 1 required participants to complete an online questionnaire and Stage 2 involved completion of the CANTAB assessments. Of the 547 respondents who initially registered for the study, 240 did not proceed to or fully complete Stage 2 of the study. After removal of outlier data on the basis on Mahalanobis distance calculations, the final sample consisted of 296 participants (148 female, 148 male). Participants were aged from 55 to 87 years, with a mean age of 68.6 years (*SD* = 6.80 years). The average age of males was approximately two years older than females. Further discussion of the sample is presented in the Results section below.

Materials

The Stage 1 online questionnaire comprised both qualitative and quantitative questions, with an approximate completion time of 15 minutes (see Appendix A for a copy of the main scales used in Stage 1). The variables of interest from the Stage 1 questionnaire include demographic information (age, gender, highest level of education), self-report aspects of healthy aging (HABC), and financial literacy measures. At the end of the questionnaire, respondents were given the option to participate in Stage 2 of the study and were directed to the CANTAB web-based platform.

Self-rated dementia symptoms – the HABC Monitor.

Subjective cognitive functioning was measured using the Healthy Aging Brain Care Monitor (HABC; Monahan et al., 2012). The scale consists of 30 items describing aspects of daily life that can be affected by dementia symptoms and is divided into four subscales:

cognitive (HABC_Cog; 6 items), functional (HABC_Func; 9 items), behavioural and psychological (HABC_B&P; 11 items), and quality of life (HABC_QOL; 4 items) (see Appendix A for scale items). Respondents rate the frequency with which they experienced problems with each item over the past two weeks, scoring 0-3 points per item, where *(0) = not at all [0-1 day]* to *(3) = almost daily [12-14 days]* on the 4-point scale. Scores (HABC_Total) range from 0-36, with higher scores representing more symptoms or worse performance. The HABC demonstrates a high degree of reliability and validity for the assessment and monitoring of the severity of dementia-related symptoms (Monahan et al., 2012). Comparable to previous studies (Earl, Gerrans, Asher, & Woodside, 2015; Monahan et al., 2012, Cronbach's a = 0.88 and 0.92, respectively) overall internal consistency was high (Cronbach's a = 0.85).

Self-rated financial literacy and applied financial literacy.

Financial literacy (FL) was measured using a 13-item scale previously validated by Fernandes, Lynch and Netemeyer (2014) (see Appendix A for scale items). The scale included basic concepts around numeracy, money value, and inflation, as well as advanced concepts regarding things such as risky assets and volatility. An additional self-check question was included to gauge participant's prediction of their financial literacy scores (FL_Predicted) asking participants "Of the previous set of questions about finances and money, how many do you think you answered correctly?". Items were score as either 0 = incorrect or 1 = correct. The total score was the sum of the 13 items, ranging from 0 to 13 where higher scores represented higher levels of financial literacy.

Applied financial literacy (Applied_FL) was assessed through a 4-item scale reported in Earl et al. (2015) (see Appendix A for scale items). The scale delivers an applied measure of financial literacy and examines management of financial assets, superannuation, and the

age pension. Items were score as either 0 = incorrect or 1 = correct. A higher score indicated better applied financial literacy. Again, a self-check question was included, asking participants to predict the number of items correctly answered (Applied FL_Predicted).

CANTAB

Objective measures of cognitive function were assessed via three online assessments through CANTAB: the Paired Associated Learning task (PAL); the Spatial Working Memory task (SWM); and the Rapid Visual Processing task (RVP) (see Appendix B for screen display examples of the PAL, SWM, and RVP tasks). Two reasons surround the use of these three tests from the CANTAB assessment library. Firstly, these are the only tests that are currently available on the new web-based platform that allows testing of participants remotely, rather than testing participants in a laboratory setting. Secondly, given the study requirements, cognitive domains of interest, and timeframe for testing; the combination of the three tests proved to be the best fit for the project. The PAL, SWM and RVP are the most widely used CANTAB tests and together provide a highly sensitive measure of the cognitive domains of visual episodic memory (PAL), working memory (SWM), and sustained attention (RVP).

The PAL test assesses episodic memory, visual memory and learning ability (Cambridge Cognition Ltd., 2012). The assessment contains aspects of both a delayed response procedure and a conditional learning task. Participants are required to recall the spatial location of a predetermined number of unique patterns within a display matrix. In this test, boxes appear on the screen and are successively opened in a random order for three seconds each. One or more boxes contain a pattern, which is then displayed in the middle of the screen and respondents are required to select which box originally contained the pattern. The level of difficulty increases throughout the test, ranging from two to eight patterns to be remembered. Completion time for the test is approximately 8 minutes. The total number of

errors for the six-box sequences adjusted for incomplete or failed trials (PAL "Total errors adjusted" [PALTEA6]) was used as the outcome measure (Cambridge Cognition Ltd., 2012), with higher scores indicating more errors and poorer performance.

The SWM test assesses visuospatial working memory and components of executive function (Cambridge Cognition Ltd., 2012). The task challenges participants to retain spatial information and manipulate remembered items in working memory, demanding executive function recruitment while also providing measures of strategy and working memory errors. In this test, the participant must search through an increasing number of boxes to locate a required number of hidden 'tokens'. The number of boxes increases from 3 to 8. Errors result when participants search boxes more than once during a sequence. The task takes approximately 4 minutes to complete. SWM "Between errors" (SWMBE) was used as the outcome measure for this analysis, which reports the number of times a box is re-opened in which the token has previously been found, indicating a failure to recall (Cambridge Cognition Ltd., 2012). Higher scores represent poorer performance.

The RVP test assesses visual sustained attention and processing speed (Cambridge Cognition Ltd., 2012). The task takes approximately 9 minutes to complete. In this task, digits from 1 to 9 appear on the screen in a pseudorandom order at the rate of 100 digits per minute. Participants are required to register when they detect target sequences of three digits (e.g., 2-4-6, 3-5-7). Difficulty varies with either one to three sequences to be remembered, with two sequences delivered in this study. "RVPA" (RVPA) was used as the outcome measure in the following analysis. RVPA is a ratio score of the probability of a correct 'hit' to the probability of a 'miss', reflecting the accuracy of the respondent to detect target sequences (Cambridge Cognition Ltd., 2012).

Results

Initial Analysis

Results were analysed using SPSS version 20.0 for Windows statistical package. Analyses were conducted in several diagnostic steps. Firstly, a correlational analysis was conducted to examine whether gender differences were apparent between the variables of interest and a MANOVA was performed to investigate whether there are real differences between men and women on the various measures. Next, hierarchical regression models were conducted to investigate the relationship between the genuine and predicted financial literacy scores, and whether any of the self-report measures approximate the CANTAB cognitive measures in predicting cognitive functioning.

Descriptive Statistics

The majority of respondents had completed a bachelor degree / post-secondary certification (47%) or postgraduate-level qualification (31%). Whilst there is an even spread of males to females, the present sample profile is different to that of the general Australian population aged 55 to 64 years where the proportion of people with an university degree or higher was 21% in 2011 (ABS, 2012). Overall, the present sample was better educated with a higher socio-economic status than the comparable Australian population. The majority of respondents were retired (63%) or semi-retired (15%) from the workforce, with the remainder in full-time or part-time work. Two respondents had previously been diagnosed with dementia (0.7%), with 8.1% of the sample indicating that they had been a primary carer for someone with Alzheimer's Disease (AD) or another type of dementia. Over half of the respondents (54.1%) reported knowing someone with AD or another type of dementia.

The overall mean scores for the CANTAB assessments are presented in Table 1 (see Appendix C). Note that the PALTEA6 and SWMBE assessments are negatively scored in the sense that a higher number represents a larger number of errors and a poorer score. The RVPA is positively scored, with zero representing a 'poor' score and one representing a 'good' score.

Bivariate Correlation

Subjective scores on the HABC scales and various financial literacy scales were correlated with the objective cognitive measures obtained from the CANTAB across gender (see Table 2 in Appendix C for correlation matrix). A correlational analysis of age with each CANTAB score suggests age is positively associated with a higher number of errors on the PALTEA6 and SWMBE tasks (females $r = .22$, $r = .28$; males $r = .23$, $r = .34$, respectively; $p < .01$ for all), and poorer performance on the RVPA (females $r = -.21$; males $r = -.29$ $p < .05$ for all), reflected in a lower "hit to miss" ratio as age increases.

As was expected, the four HABC subscales were significantly positively correlated with each other and consistent across gender. Interestingly, there were no significant relationships between self-rated cognitive ability (HABC_Cog) and the three objective cognitive measures (PALTEA6, SWMBE, RVPA) for either gender, suggesting that people are not good judges of their own cognition. The two financial literacy measures correlated significantly with one another suggesting one could substitute for the other in future studies. Significant correlations between the financial literacy, applied financial literature and associated predicted measures for both males and females provide validation of the sample's degree of self-insight based on the predictions of the two financial measures. However, given the lack of significant correlations between the HABC and CANTAB subscales, the level of self-insight did not extend to the assessment of cognitive functioning. This finding could be

due to financial literacy abilities being utilised on a regular basis where people have easy access to feedback on their performance, whereas cognition is a more abstract concept and is therefore harder to judge.

In order to determine whether some measures were operating as proxies for others, the correlation matrix was analysed further. As was expected, no significant correlations were noted between the various financial literacy measures and the HABC scales. Interestingly, there were various significant correlations between the financial literacy (FL) scale and CANTAB measures, such that the financial literacy scale significantly correlated with the SWMBE and RVPA subtasks, and with the PALTEA6 for males only. These relationships are explored further in the following regression models to investigate whether the financial literacy scale could approximate the use of the CANTAB measures in assessing cognitive functioning.

The three CANTAB subtasks correlated such that the RVPA subtest was significantly negatively correlated with PALTEA6 and SWMBE. Interestingly, the PALTEA6 and SWMBE subtests were only significantly positively correlated for males ($r = .38$, $p < .01$) (see Table 2 in Appendix C). Further calculations using the *Fisher r-to-z* transformation[1] were applied to assess the significance of the difference between the gender samples and indicated that the difference in the strength of this correlations was significantly different between females and males ($p = .03$). It is not clear how to account for this result, and it is investigated further in the following MANOVA to determine whether a real difference exists.

[1] Fisher r-to-z calculator accessed at http://vassarstats.net/rdiff.html.

MANOVA

In order to answer Research Question 1, a one-way between-groups multivariate analysis of variance (MANOVA) was performed to investigate gender differences between the various measures (see Table 3 in Appendix C). The dependent variables were: the five HABC scales, six financial literacy measures, and the three CANTAB measures. In line with Research Question 1a, no gender differences were identified between men and women on the HABC or CANTAB scores. Consistent with Research Question 1b, results revealed statistically significant differences between men and women on the actual and predicted financial literacy scores suggesting real differences exist between genders. Mean scores indicated that females reported greater uncertainty and lower confidence in their predicted scores than males, with males obtaining better overall financial literacy scores than females (see Table 3 in Appendix C).

Hierarchical Regression

In order to answer Research Question 2 and determine whether people are good judges of their own cognition and if the use of objective measures of cognition could be substituted, a series of hierarchical regression analyses were conducted.

Financial Literacy

In line with Research Question 2a, a hierarchical multiple regression was used to assess whether participant predicted scores anticipated actual financial literacy scores, after controlling for the influence of age and education (see Table 4-5 in Appendix C). Separate analyses were conducted for females and males.

Females. Age and education were entered at Step 1, explaining 10% of the variance in financial literacy (refer Table 4 Appendix C). After entry of the predicted financial literacy measure at Step 2, the total variance explained by the model as a whole was 32% (F (3, 144) = 120.49, $p < .001$). The predicted financial literacy measure explained an additional 22% of the variance in actual financial literacy score for females. In the final model, education and the predicted financial literacy scores were statistically significant, with the predicted financial literacy score recording a higher beta value (β = -.48, $p < .001$) than education (β = -.22, $p < .05$).

Identical analyses were conducted for applied financial literacy (see Table 5 in Appendix C). After entry of the predicted applied financial literacy measure at Step 2, the total variance explained by the model as a whole was 31% (F (3, 143) = 21.22, $p < .001$). Only the predicted applied financial literacy measure reached significant (β = -.56, $p < .001$).

Males. For males, Step 2 of the regression model explained a total of 34% of the variance in financial literacy (F (3, 144) = 55.87, $p < .001$) (see Table 4 in Appendix C). Age, education and predicted financial literacy were statistically significant, with the predicted financial literacy score recording a higher beta value (β = -.49, $p < .001$) than age and education.

Analyses on the applied financial literacy measure indicated that the predicted applied financial literacy score at Step 2 explained a total of 49% of the variance in actual applied financial literacy (F (3, 142) = 23.07, $p < .001$) (see Table 5 in Appendix C). The predicted applied financial literacy measure explained an additional 43% of the variance in actual financial literacy score for males, over and above age and education. In the final model, only the predicted applied financial literacy was statistically significant (β = -.67, $p < .001$).

Overall, these findings suggest that there is a relationship between the two measures of financial literacy and the two measures of predicted financial literacy, suggesting that

people are good at predicting what their true financial literacy scores will be and the predicted financial literacy scores are a good proxy for actual financial literacy scores.

CANTAB

To investigate Research Question 2b; whether the self-report measures of the HABC and financial literacy scales could approximate the objective cognitive measures of the CANTAB subscales, a three step hierarchical regression analysis was conducted. Separate models were considered for each of the cognitive outcome measures (i.e., PALTEA6, SWMBE, RVPA). In the models, presented in Tables 6 - 8 (see Appendix C), demographic variables are entered at Step 1, followed by the total scores for financial literacy and applied financial literacy at Step 2, and the four HABC subscales at Step 3.

PALTEA6 (Table 6). Demographic variables significantly accounted for 6% of the total variance in PALTEA6. However, age was the only demographic variable to significantly predict PALTEA6, with older age predicting poorer performance (β = .21, p < .01). The two financial literacy constructs at Step 2 together predict 1% of the variance in PALTEA6 after controlling for demographic variables (R^2 = .07; F(5, 289) = 4.32, p < .001), where age remained the only significant predictor of PALTEA6 (β = .20, p <.01). Consistent with the non-significant intercorrelations reported in Table 2 the four HABC variables at Step 3 did not significantly account for any additional variance in PALTEA6 (ΔR^2 = .01; F(9, 283) = 2.55, p >.001)

SWMBE (Table 7). Demographic variables significantly accounted for 13% of the total variance in SWMBE. Both age and education were significant positive predictors (β = .28, p <.001; β = .16, p <.01, respectively). The two measures of financial literacy at Step 2 accounted for an additional 3% of the variance, (ΔR^2 = .03), increasing the total amount of variance explained to 15% (R^2 = .15; F(5, 287) = 10.44, p <.001). Age and education were

significant positive predictors (β = .25, p <.001; β = .12, p <.05, respectively) and financial literacy was a significant negative predictor of SWMBE (β = -.19, p < .01). Lastly, the four HABC subscale scores entered at Step 3 significantly explained an additional 1% of variance, raising the total amount of variable in SWMBE explained by the final model to 16%. Consistent with the model output at Step 2, age was a significant positive predictor of SWMBE (β = .27, p < .001), whilst financial literacy was a significant negative predictor (β = -.19, p < .01).

RVPA (Table 8). The first step of the model was statistically significant (F(3, 289) = 8.51, p < .001), revealing that the demographic variables explained 8% of variance in RVPA (R^2 = .08). Age was a significant negative predictor (β = -.24, p <.001). The two measures of financial literacy at Step 2 accounted for an additional 6% of the variance (ΔR^2 = .06; R^2 = .14; F(5, 287) = 9.03, p <.001), where financial literacy was a significant positive predictor of RVPA (β = .27, p < .001), and age (β = -.20, p < .01) and gender (β = -.12, p < .05) were significant negative predictors. Lastly, Step 3 of the regression model shows the four HABC-SR variables together accounted for an additional 1% of the variance in RVPA (ΔR^2 = .02). This was a significant increase of variance explained by the model (F(9, 283) = 5.65, p < .001), raising the total proportion of variance explained by the final model to 15% (R^2 = .15). Examination of the standardised beta values in Step 3 suggests that gender (β = -.14, p < .05) and age (β = -.17, p < .01) were significant negative predictors of RVPA, whilst the financial literacy scale (β = .28, p < .001) was a significant positive predictor. The financial literacy score was more important in the prediction of RVPA than the demographic variables.

However, as depicted in the MANOVA results (see Table 3 in Appendix C), there were no significant differences between men and women on the RVPA subtask (female M = .91; male M = .90). This result could be explained by the fact that age matters more in performance on the RVPA than the other two CANTAB measures and the study sample

consisted of more older men than women, where the average age of males was approximately two years older than females.

Discussion

Overview of the Present Study

The present study had two aims: first, to identify whether real differences exist between men and women on the various measures of cognitive functioning, and second, to explore the relationship between subjective and objective cognitive measures to determine whether one could substitute the use of the other. Overall, the results indicate that gender differences exist in the financial literacy measures, with no gender differences on the HABC or CANTAB measures. The analyses also suggest that the subjective measures of the HABC and financial literacy scales cannot act as substitute measures for the objective CANTAB assessments. A discussion of the current findings, how they relate to present literature, as well as the practical implications, limitations and future research directions is presented below.

Gender differences across measures

An investigation of gender on the various cognitive measures indicated that true gender differences existed on the financial literacy measures, as was expected. Consistent with previous research, men performed better on the financial literacy scales, and provided higher levels of confidence in predicting their overall financial literacy score (Lusardi & Mitchell, 2008; 2010). In line with this, women were more likely to respond “don’t know” to the items in the financial literacy scale, suggesting either a lack of financial knowledge or underestimations of their financial abilities.

No gender differences were apparent in the HABC scales or CANTAB assessments, suggesting that these two measures provide possible gender-neutral solutions to the assessment of cognitive functioning, although scores on the RVPA require further investigation. Interrelations of age with each of the CANTAB assessments suggests that age is a predictor of performance on the subtests, where older age is associated with a higher number of errors and poorer performance on all three subtests for both men and women. Therefore, age appears to be a more important demographic variable in predicting performance on the CANTAB subtasks than gender.

Are people good judges of their own cognition? A proxy for objective cognitive assessments.

Contrary to expectations, no relationships were found between the self-rated dementia scale (HABC) and the objective dementia assessment (CANTAB). Specifically, the lack of a relationship between the HABC Cognitive subscale and the CANTAB assessments reinforces the notion that people are in fact not good judges of their own cognition. This finding suggests that it is not sufficient to rely on self-ratings of cognitive functioning. It is not clear why the self-rated cognitive dementia symptoms and the cognitive ability measures were unrelated. It may be that while people are able to recognise behavioural declines, declines in cognitive functioning escape them. The HABC items concern everyday tasks and it may be that people with cognitive deterioration remain able to cope with performing such duties as the tasks have become routine and simple to perform. The relation between self-evaluations and objective performance on familiar tasks is expected to be stronger than for unfamiliar tasks, as familiar tasks provide more opportunities to receive diagnostic feedback on one's performance. In unfamiliar tasks, people have little experience to inform the basis of their self-evaluations (Bandura, 1977; Kruger & Dunning, 1999). This emphasises the importance of external testing, rather than relying on self-report measures and suggests independent

measures of cognitive ability may provide superior indications of impairments in cognitive functioning than self-ratings. It also questions the use of self-rated 'checklists' that are in common use on dementia websites as it does not appear to be sufficient to let people self-diagnose their cognitive state. Subjective measures of cognitive functioning are unlikely to pick up on objective performance, unless the respondent has significant deterioration that intrudes of their everyday life and activities.

People may not be very good judges of their own ability due to the influence of other psychosocial factors confounding assessment accuracy, such as self-efficacy. Self-efficacy refers to one's confidence in their ability to successfully execute a specific behaviour or task and is an important variable in predicting individual behaviour (Bandura, 1977). It could be assumed from the results that self-efficacy may be working as a covariate to moderate the relationship between the subjective self-rated scores of cognition and the objective measures of cognitive functioning, where the difference between the self-rated and objective scores is greater the lower an individual's self-efficacy scores are. Due to time constraints, self-efficacy was not measured in the present study. However, future research could benefit from employing a measure of self-efficacy, such as Mastery, to observe the effects on the relationship between self-rated and objective measures of cognitive functioning.

Theoretical and Practical Implications

The results of the current study have important theoretical and practical implications. Findings provide support for the practical utility of dementia screening interventions for monitoring cognitive functioning in the work environment. The results further highlight the importance that assessment of cognitive functioning has in promoting better retirement planning. Taken together, these findings call attention to the important role that employers

and Organisational Psychologists have in promoting dementia screening among the elderly Australian workforce.

Obtaining a diagnosis of dementia can be a difficult, lengthy and intensive process. Accurate dementia diagnosis through brief, non-invasive, and easily accessible screening instruments, such as the CANTAB, is important to ensure patients have prompt access to healthcare and support services, and be provided the opportunity to have an active role in decisions regarding their future whilst they are still cognitively aware, including planning for retirement and how and when to exit the workforce. Early awareness about and diagnosis of dementia are the first steps in designing successful disease management strategies. As more effective treatments for dementia become available in the future, early diagnosis will become even more important. Thus, it is imperative that research is conducted now to identify the most effective, sensitive and user-friendly dementia screening measures.

It is important not to lose sight of the fact that the current sample is still a vulnerable group in the dementia domain. Whilst the sample was of a high socioeconomic background with high levels of education; factors which have some support for mitigating the effects of dementia; this group is also the most at risk of underdiagnosis of dementia through the use of current measures, such as the MMSE and self-assessments (Mitchell, 2009; Tombaugh & McIntyre, 1992). Higher levels of education enable respondents to utilise techniques to better their performance in measures like the MMSE, and may lead individuals to overestimate their cognitive abilities and underestimate their dementia symptoms on self-rated assessments, such as the HABC. The purpose of the MMSE is to identify individuals with cognitive impairment and, as such, the scale contains items focused at the lower end of cognitive function. As a result, more educated individuals will produce ceiling effects in this measure as it is less sensitive to change at high levels of function. This can cause the earlier symptoms of dementia to be undetected by the assessment. Thus, by the time the MMSE detects decline

in demented individuals with higher education, they may be further along in the dementia process than when the MMSE would register dementia symptoms in less educated individuals. It is also likely that the relationship between educational attainment and declines in cognitive functioning is more complex (Piccinin et al., 2012). Previous research has shown that higher education may reduce or delay decline in the preclinical stages of dementia, but it can also accelerate decline once pathology has progressed beyond the level at which individuals are able to offset with their higher education (Hall et al., 2007). Thus, highlighting the need to employ dementia screening measures that are sensitive to age-related decline, intellectual deterioration and the early effects of dementia; of which the CANTAB has been proven successful of (Robbins et al., 1994; 1998; Sahakian et al., 1988; 1993).

Limitations and Future Research Directions

Although the present study provides valuable insight into the use of various cognitive assessment methods, the results must be interpreted within the context of several limitations. The sample was highly educated with high socioeconomic backgrounds and therefore was not representative of the general Australian population aged over 55. However, it could be argued that this population is of special interest due to the confounding issues of education and other methods of dementia assessment. Furthermore, this population is more likely to be self-managing assets than those with lower levels of education, such as self-managed super funds (ATO, 2015). The CANTAB results suggest that impaired cognitive functioning was not apparent in the sample. Future research should address this limitation by targeting those underrepresenting groups including lower education levels and socioeconomic backgrounds, and those less familiar with computer use. Further methodological concerns relate to the completion of the CANTAB assessments, which required the respondent to access a secondary website to complete the CANTAB. This could have contributed to the significant

participant withdrawal rate. Additionally, the use of self-rated instruments does not come without limitations as self-evaluations are subject to a great deal of errors resulting from self-enhancement desires. Previous research has shown that people cannot analyse themselves objectively or reliably enough to provide accurate information (Mabe & West, 1982). The HABC scale data shows floor effects, suggesting the scale had poor resolution for identifying participants with impaired cognitive functioning. Future research could consider employing lower level questions that people are more likely to answer 'yes' to. As the results indicate that the financial literacy and applied financial literacy scales could substitute one another, future studies investigating financial literacy and the impacts of cognitive capacity should use applied measures of financial literacy as the present study has done here, to gain an accurate picture of financial ability (Earl et al., 2015). Future research should also consider employing a measure of self-efficacy as current findings on gender differences could be due to underlying factors, potentially self-efficacy. The present study was the first data collection point in a wider, longitudinal study; thus the results will be able to be analysed across time in the future.

Concluding Comments

The current study highlights the importance of considering factors, such as cognitive well-being and capacity, in older workers in an organisational context and to gain an holistic understanding of planning for retirement. Clearly, objective assessments are needed and relying on subjective measures alone may leave people vulnerable to making poorly informed decisions. Specifically, this study is a valuable starting point for the exploration of different methods of assessing cognitive functioning, but highlights the need for further investigation and longitudinal data. Longer term, this study has established baseline data on cognitive functioning where participants have opted in to future contact. This provides an excellent

base for future research, which can leverage this investment to allow monitoring over time and examine the dynamics of cognitive health and decision-making. As the number of individuals with dementia increases, so does the demand for new and efficient ways of monitoring cognitive functioning and detecting cognitive impairments. The ability to easily diagnose dementia is invaluable. To this end, individuals, organisations and Organisational Psychologists all have an important role to play in promoting dementia screening in the Australian workforce and wider population.

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Appendix A

Selected items from Stage 1 Questionnaire

Health Brain Centre Monitor (HABC: Monahan et al., 2014)

Over the past 2 weeks, how often did you have problems with: [Answered on the following scale]

Not at all	Several days	Most days	Almost daily
(0-1 day)	(2-6 days)	(7-11 days)	(12-14 days)
(1)	(2)	(3)	(4)

COGNITIVE DOMAIN

1. Judgement or decision-making.
2. Less interest or pleasure in doing things, hobbies or activities.
3. Repeating the same things over and over such as questions or stories.
4. Learning how to use a tool, appliance, or gadget.
5. Forgetting the correct month or year.
6. Handling complicated financial affairs such as balancing cheque book & paying bills.
7. Remembering appointments.
8. Thinking or memory.

FUNCTIONAL DOMAIN

9. Planning, preparing or serving meals.
10. Taking medications in the right dose at the right time.
11. Walking or physical ambulation.
12. Bathing.
13. Shopping for personal items like groceries.
14. Driving.
15. Falling and tripping.
16. Housework or household chores.

BEHAVIOURAL AND PSYCHOLOGICAL DOMAIN

17. Feeling down, depressed, or hopeless.
18. Feeling lonely.
19. Resisting help from others or getting agitated.
20. Feeling anxious, nervous, tense, fearful or panic.
21. Believing others are stealing from you or planning to harm you.
22. Hearing voices, seeing things or talking to people who are not there.
23. Poor appetite or overeating.
24. Falling asleep, staying asleep, or sleeping too much.
25. Acting impulsively, without thinking through the consequences of your actions.
26. Wandering, pacing, or doing things repeatedly.

QUALITY OF LIFE

27. Quality of life
28. Your financial future
29. Your mental health
30. Your physical health

Financial Literacy (FLN: Fernades, Lynch, & Netemeyer, 2014)

This section contains a series of quiz type problems. Could you please answer each of the following? Please answer as best you can without searching for an answer. We collect your answers and the total time taken to answer.

1. Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy:

   More than today with the money in this account (1)

   Exactly the same as today with the money in this account (2)

   Less than today with the money in this account (3)

   Don't know (4)

2. Considering a long time period (e.g. 10 or 20 years), which asset normally gives the highest return?

   Savings account (1)

   Shares (2)

   Bonds (3)

   Do not know (4)

3. Considering a long time period (e.g. 10 or 20 years), which asset normally displays the highest fluctuations?

   Savings account (1)

   Shares (2)

   Bonds (3)

   Do not know (4)

4. Do you think that the following statements are True or False?

a. If you were to invest $1000 in a shares managed fund, it would be possible to have less than $1000 when you withdraw your money	True (1)	False (2)	Don’tknow (3)
b. A share managed fund combines the money of many investors to buy a variety of shares	True (1)	False (2)	Don’tknow (3)
c. After age 65, you have to withdraw at least some money from your superannuation fund.	True (1)	False (2)	Don’tknow (3)
d. A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less	True (1)	False (2)	Don’tknow (3)
e. Fixed interest securities (bonds) are normally riskier than shares	True (1)	False (2)	Don’tknow (3)

5. Which of the following statements is correct?

   Once one invests in a managed fund, one cannot withdraw the money in the first year (1)

   Managed funds can invest in several assets, for example invest in both stocks and bonds (2)

   Managed funds pay a guaranteed rate of return which depends on their past performance (3)

   None of the above (4)

   Don't know (5)

6. Suppose you had $100 in a savings account and the interest rate is 20 per cent per year and you never withdraw money or interest payments. After 5 years, how much would you have in this account in total?

   More than $200 (1)
   Exactly $200 (2)
   Less than $200 (3)
   Don't know (4)

7. When an investor spreads his/her money among different assets, does the risk of losing money:

   Increase (1)
   Stay the same (2)
   Decrease (3)
   Don't know (4)

8. Which of the following statements is correct? If somebody buys a fixed interest security (bond) of firm B:

   He/She owns a part of firm B (1)
   He/She has lent money to firm B (2)
   He/She is liable for firm B's debts (3)
   None of the above (4)
   Don't know (5)

9. Suppose you owe $3,000 on your credit card. You pay a minimum payment of $30 each month. At an Annual Percentage Rate of 12% (or 1% per month), how many years would it take to eliminate your credit card debt if you made no additional new charges?

   Less than 5-years (1)
   Between 5 and 10-years (2)
   Between 10 and 15-years (3)
   Never (4)
   Don't know (5)

Applied Financial Literacy

Here are a few more questions about money, superannuation, and the government age pension. Please indicate what you think is the correct answer.

1. You have $200,000 deposited in an account with a superannuation fund regulated by the Australian Prudential Regulation Authority. If the fund makes legal, but bad investments, and loses half of its value the money is lost - there is no guarantee on the investment.

True (1) False (2) Don't Know (3)

2. Max and Marion are 68 years of age and sell their family home to downsize for a townhouse. After the sale and purchase they have $300,000 extra cash free. Which of the following is correct?

a. The extra cash is not counted for the government age pension assets test as it is from the sale of their home	True (1)	False (2)	Don't know (3)
b. They can give the $300,000 as a gift to their children this year to avoid any impact on their government age pension	True (1)	False (2)	Don't know (3)

3. Imagine you have the following two credit cards:

1. A Mastercard with a $ 100 (one hundred) balance and a 15% annual percentage rate

2. A Visa card with a $1,000 (one thousand) balance and a 10% annual percentage rate.

Now imagine you have just received $1000 and you have decided to use all the money to repay debt. How much would you repay on each card? (enter just numbers - no dollar signs)

_____ MasterCard (1) _____ Visa (2)

Appendix B

CANTAB assessments.

Objective measures of cognitive function were assessed using three online assessments through CANTAB: the Paired Associates Learning task (PAL); the Spatial Working Memory task (SWMBE); and the Rapid Visual Processing task (RVPA).

Paired Associates Learning (PAL).

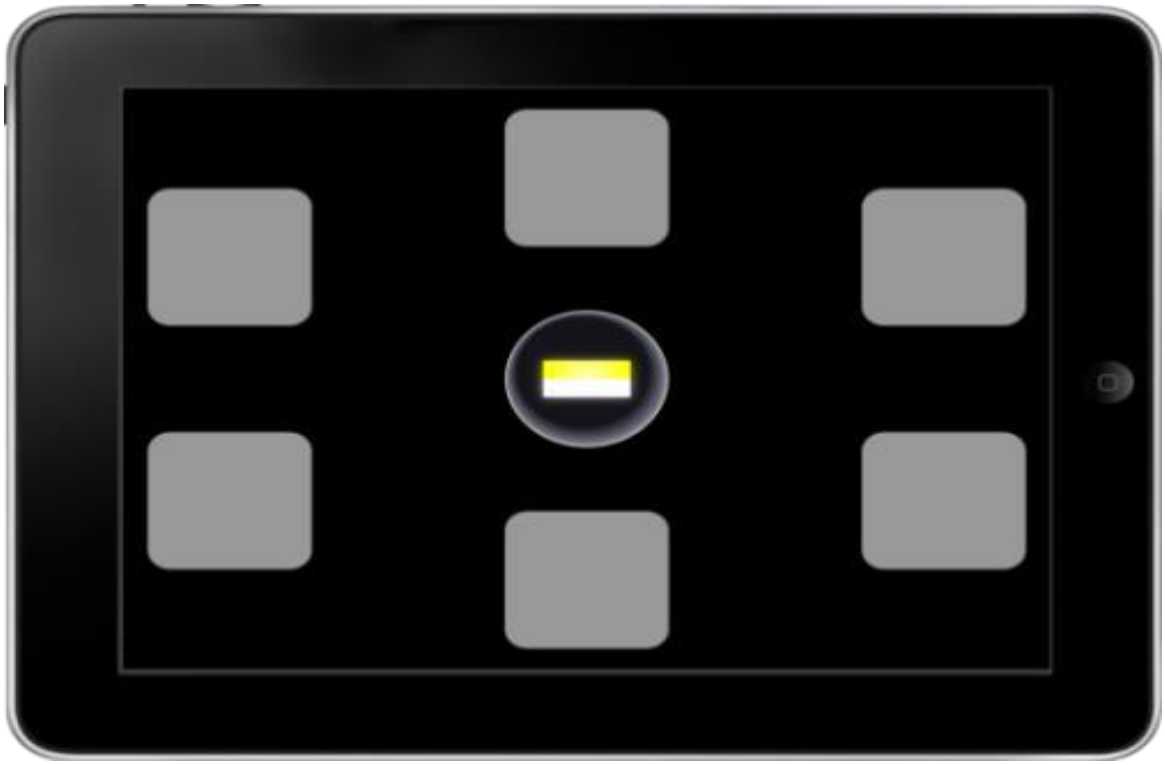

Figure 1. Screen display of CANTAB Paired Associates Learning task

Spatial Working Memory (SWMBE).

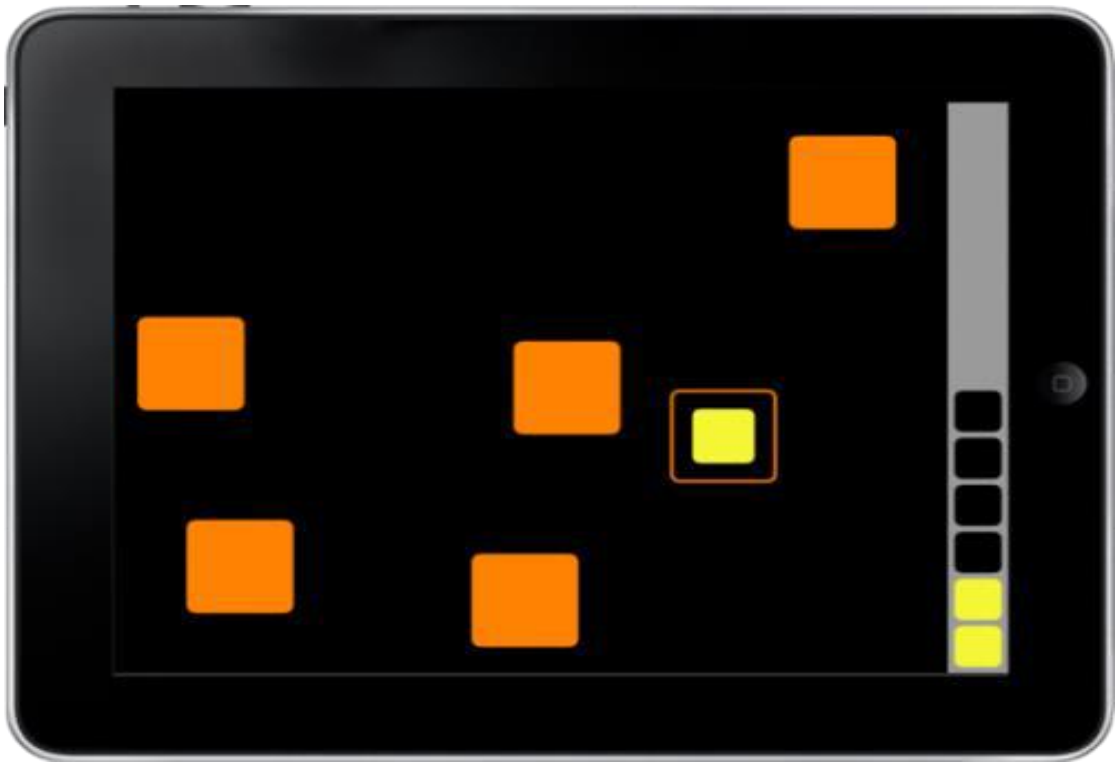

Figure 2. Screen display of CANTAB Spatial Working Memory task.

Rapid Visual Information Processing (RVPA).

Figure 3. Screen display of CANTAB Rapid Visual Processing task.

Appendix C

Results Output

Table 1.

Descriptive statistics for the CANTAB assessments.

	n	Minimum	Maximum	*M*	*SD*
PALTEA6	296	0	20	5.60	5.57
SWMBE	296	0	32	13.99	8.56
RVPA	296	0	1	.90	.05

Table 2.

Spearman's Correlations for age, and subjective and objective cognitive measures by gender.

Female	*M*	*SD*	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Age	67.61	6.65	-	-.20*	.22**	.02	.09	.00	.13	-.11	-.05	-.03	.22**	.28**	-.21*
2. FL	9.22	2.73		-	-.48**	.32**	-.09	-.12	-.07	-.04	-.09	-.08	-.07	-.30**	.28**
3. FL_Predicted	-.20	2.80			-	-.10	.26**	-.05	-.02	-.13	-.09	-.13	.02	.17*	-.20*
4. Applied_FL	2.61	1.08				-	-.57**	-.07	-.10	-.09	-.12	-.07	-.02	-.11	.02
5. Applied FL_Predicted	.05	1.16					-	.05	.13	-.04	.06	-.01	.03	-.01	-.03
6. HABC_Cog[1]	.90	1.34						-	.53**	.53**	.48**	.73**	.03	-.07	-.04
7. HABC_Func[2]	.68	1.34							-	.53**	.60**	.72**	.14	-.03	-.15
8. HABC_B&P[3]	1.82	2.55								-	.60**	.86**	.04	-.13	.05
9. HABC_QOL[4]	1.20	1.68									-	.80**	.15	-.06	-.07
10. HABC_Total[5]	4.60	5.81										-	.11	-.12	-.03
11. PALTEA6[6]	5.20	5.40											-	.14	-.22**
12. SWMBE[7]	14.16	8.06												-	-.23**
13. RVPA[8]	.90	.05													-

Table 2 (continued)

Male	*M*	*SD*	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Age	69.51	6.84	-	-31**	.11	-.09	.04	-.05	.17*	-.08	-.06	-.04	.23**	.34**	-.29**
2. FL	10.89	1.76		-	-.49**	.36**	-.12	-.08	-.15	-.08	-.03	-.07	-.23**	-.28**	.29**
3. FL_Predicted	.42	1.91			-	-.08	.27**	-.05	-.02	-.10	-.07	-.13	.09	.09	-.14
4. Applied_FL	2.91	.99				-	-.66**	.06	-.05	-.06	-.03	-.01	-.10	-.09	.14
5. Applied FL_Predicted	.36	1.09					-	-.16	-.04	-.12	-.08	-.16	.06	-.03	-.06
6. HABC_Cog[1]	1.18	1.49						-	.44**	.60**	.53**	.79**	-.01	-.00	.05
7. HABC_Func[2]	.66	1.30							-	.39**	.53**	.63**	-.04	.11	-.17*
8. HABC_B&P[3]	2.04	2.73								-	.63**	.86**	.02	.10	-.01
9. HABC_QOL[4]	1.27	1.75									-	.82**	-.03	.02	.06
10. HABC_Total[5]	5.15	6.15										-	-.03	.10	.01
11. PALTEA6[6]	5.99	5.76											-	.38**	-.27**
12. SWMBE[7]	.90	.06												-	-.36**
13. RVPA[8]	13.82	9.12													-

Note. [1] is Healthy Aging Brain Centre monitor cognitive domain, [2] is Healthy Aging Brain Centre monitor functional domain, [3] is Healthy Aging Brain Centre monitor behavioural and psychological domain, [4] is Healthy Aging Brain Centre monitor quality of life domain, [5] is Health Aging Brain Centre monitor total score, [6] is Paired Associated Learning score, [7] is Spatial Working Memory score, [8] is Rapid Visual Processing score. $n = 296$ (cases deleted pair-wise). Significance codes: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 3.

MANOVA results for gender differences across various measures.

IV	**DV**	**F**	**d/f**	**Sig**	**Partial η^2**	***M*** Female	***M*** Male
Gender							
	HABC_Cog	2.97	1	.09	.01	.90	1.19
	HABC_Func	.02	1	.88	.00	.68	.66
	HABC_B&P	.53	1	.47	.00	1.82	2.04
	HABC_QOL	.10	1	.75	.00	1.20	1.27
	HABC_Total	.62	1	.43	.00	4.60	5.15
	FL	38.37	1	.00	.12	9.22	10.89
	FL_Don't Know	24.25	1	.00	.08	1.72	.60
	FL_Predicted	5.26	1	.02	.02	-.26	.36
	Applied_FL	6.08	1	.01	.02	2.61	2.91
	Applied FL_Don't Know	6.60	1	.01	.02	.63	.39
	Applied FL_Predicted	5.53	1	.02	.02	.05	.36
	PALTEA6	1.49	1	.22	.01	5.20	5.99
	SWMBE	.12	1	.73	.00	14.16	13.82
	RVPA	.92	1	.34	.00	.91	.90

$F(13, 279) = 7.84$, $\rho = .000$, Wilk's lambda = .732

Table 4.

Hierarchical multiple regression analysis for predicted financial literacy predicting true financial literacy score (n = 296).

Financial Literacy (FL)						
Female						
	Variable	R^2	ΔR^2	*B*	*SE B*	β
Step 1		.10	.10			
	Constant			14.23	2.25	
	Age			-.06	.03	-.14
	Education			-.32	.11	-.24**
Step 2		.32	.22			
	Constant			11.97	1.98	
	Age			-.03	.03	-.06
	Education			-.29	.10	-.22**
	FL_Predicted			-.48	.07	-.48***
Male						
	Variable	R^2	ΔR^2	*B*	*SE B*	β
Step 1		.10	.10			
	Constant			15.40	1.47	
	Age			-.06	.02	-.21*
	Education			-.19	.08	-.20*
Step 2		.34	.24			
	Constant			15.47	1.27	
	Age			-.06	.02	-.21**
	Education			-.16	.07	-.18*
	FL_Predicted			-.47	.07	-.49***

Note. Significance codes: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 5.

Hierarchical multiple regression analysis for predicted applied financial literacy predicting true applied financial literacy score (n = 296).

Applied Financial Literacy (Applied_FL)						
Female						
	Variable	R^2	ΔR^2	*B*	*SE B*	β
Step 1		.00	.00			
	Constant			2.51	.93	
	Age			.00	.01	.00
	Education			.03	.05	.05
Step 2		.31	.31			
	Constant			1.99	.78	
	Age			.01	.01	.06
	Education			-.00	.04	-.01
	Applied FL_Predicted			-.52	.07	-.56***
Male						
	Variable	R^2	ΔR^2	*B*	*SE B*	β
Step 1		.06	.06			
	Constant			3.69	.82	
	Age			-.01	.01	-.04
	Education			-.12	.04	-.23**
Step 2		.49	.43			
	Constant			3.62	.60	
	Age			-.00	.01	-.03
	Education			-.06	.03	-.12
	Applied FL_Predicted			-.61	.06	-.67***

Note. Significance codes: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 6.

Hierarchical multiple regression analysis for variables predicting cognitive decline – PALTEA6 (n = 296).

Paired Associates Learning (PALTEA6)						
	Variable	R^2	ΔR^2	*B*	*SE B*	β
Step 1		.06	.06			
	Constant			.-7.22	3.22	
	Gender			.50	.64	.05
	Age			.17	.05	.21**
	Education			.24	.16	.09
Step 2		.07	.01			
	Constant			-5.11	3.81	
	Gender			.75	.69	.07
	Age			.17	.05	.20**
	Education			.20	.17	.07
	FL			-.09	.16	-.04
	Applied_FL			-.31	.33	-.06
Step 3		.08	.01			
	Constant			-6.03	3.98	
	Gender			.72	.70	.07
	Age			.18	.05	.22**
	Education			.17	.17	.06
	FL			-.09	.16	-.04
	Applied_FL			-.27	.33	-.05
	HABC_Cog			-.20	.30	-.05
	HABC_Func			-.20	.32	-.05
	HABC_B&P			.16	.19	.07
	HABC_QOL			.12	.32	.04

Note. Significance codes: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 7.

Hierarchical multiple regression analysis for variables predicting cognitive decline – SWMBE (n = 296).

Spatial Working Memory (SWMBE)						
	Variable	R^2	ΔR^2	*B*	*SE B*	*β*
Step 1		.13	.13			
	Constant			-12.37	4.79	
	Gender			-.95	.95	-.06
	Age			.36	.07	.28***
	Education			.66	.24	.16**
Step 2		.15	.03			
	Constant			-3.12	5.60	
	Gender			.21	1.01	.01
	Age			.32	.07	.25***
	Education			.49	.25	.12*
	FL			-.66	.23	-.19**
	Applied_FL			-.00	.48	.00
Step 3		.16	.01			
	Constant			-4.46	5.83	
	Gender			.21	1.03	.01
	Age			.34	.08	.27***
	Education			.45	.25	.10
	FL			-.67	.23	-.19**
	Applied_FL			.04	.49	.01
	HABC_Cog			-.41	.43	-.07
	HABC_Func			-.50	.47	-.08
	HABC_B&P			.28	.28	.08
	HABC_QOL			.11	.46	.02

Note. Significance codes: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 8.

Hierarchical multiple regression analysis for variables predicting cognitive decline – RVPA (n = 296).

Rapid Visual Processing (RVPA)						
	Variable	R^2	ΔR^2	*B*	*SE B*	*β*
Step 1		.08	.08			
	Constant			1.04	.03	
	Gender			-.00	.01	-.03
	Age			-.00	.00	-.24***
	Education			-.00	.00	-.10
Step 2		.14	.06			
	Constant			.96	.03	
	Gender			-.01	.01	-.12*
	Age			-.00	.00	-.20**
	Education			-.00	.00	-.04
	FL			.01	.00	.27***
	Applied_FL			-.00	.00	-.01
Step 3		.15	.01			
	Constant			.95	.04	
	Gender			-.01	.01	-.14*
	Age			-.00	.00	-.17**
	Education			-.00	.00	-.06
	FL			.01	.00	.28***
	Applied_FL			-.00	.00	-.02
	HABC_Cog			.00	.00	.07
	HABC_Func			-.01	.00	-.12
	HABC_B&P			.00	.00	.09
	HABC_QOL			-.00	.00	-.07

Note. Significance codes: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Appendix D

Journal of Women and Aging Publication Specifications

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