


Better ways of assessing cognitive health

October 2017

National Seniors
Australia

Publisher National Seniors Australia ABN 81 101 126 587 ISBN 978-0-6481571-0-6

Suggested citation: Earl, J.K., Gerrans, P. and Hunter, M (2017). Better ways of assessing cognitive health. Brisbane: National Seniors.

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RESEARCH DIRECTOR'S FOREWORD

Given the central importance of normal cognitive function to decision-making in later life, National Seniors Australia contracted the Flinders Business School and the University of Western Australia to undertake a study into better ways of assessing cognitive health. This research project investigates the relationship between cognitive health and financial decision-making among older Australians aged 55 years and over, and identifies factors that will encourage regular cognitive screening among older Australians.

Cognition can deteriorate without people being aware of it. Problems in planning and decision-making can occur when there is unrecognised cognitive impairment, putting people at risk. On the other hand, self-diagnosis leads people to believe that there is decline where there is none. This can be an unintended consequence of the growing awareness and promotion of the problem of dementia, leading people who haven't had the benefit of expert advice to disengage from activities and prematurely abdicate responsibility to others. Because on-going assessment is an important health prevention option, this project also examined the attitudes of older Australians to on-going cognitive screening, and the practicalities of doing it.

The study:

The study was delivered in two stages. An initial survey examined self-reported levels of cognitive function and attitudes to cognitive screening, concerns and worries about cognitive decline, objective and subjective levels of financial literacy, and decision-making networks.

Stage two was a trial of a new and innovative cognitive assessment, known as CANTAB, delivered online and completed on a computer tablet in the participants' own homes.

What the research tells us:

Cognitive health:

- Participants could be poor judges of their own cognition;
- Cognitive assessment scores deteriorated with advancing age;
- Participants with post-graduate qualifications recorded better CANTAB scores.

Cognition and financial literacy:

- Participants with lower scores in applied financial literacy also scored lower on the online cognitive assessment;
- Older participants who had lower levels of financial literacy and lower levels of education, were also associated with poorer financial literacy;
- Males performed significantly better than females in both financial literacy and applied financial literacy.

Cognition and engagement with source of advice:

- Those with lower levels of cognitive function were less likely to seek support and advice from their partner, children, of GP if they suspected a decline in cognitive function, and were more likely to use online resources for advice;
- Those with lower levels of perceived cognitive function and those with low financial literacy scores were the least likely to seek advice and support from any source.

Cognition and relationship status:

- Participants with dependants in the household recorded higher scores on the online cognitive assessments. Performance was unrelated to partnership status.

Cognitive assessment preferences:

- The new online assessments were generally well-received, despite some technical issues. More than half of the participants nominated a preference for computer or tablet-based assessments, with another third interested in on-going monitoring, but without a preference for assessment format.

In conclusion:

The cognitive assessment project is directly connected to the National Seniors research workplan, which aims to:

- Promote financial, digital, and information literacy;
- Enable choice and control through Consumer Directed Care;
- Encourage healthy ageing and behaviour change that enhances cognitive health;
- Advocate the need for informed intermediaries for people losing cognitive function;
- Support ongoing learning; and
- Facilitate greater life satisfaction and successful ageing.

National Seniors seeks to give older Australians a voice to be heard on issues relating to social inclusion, consumer protection, mature age employment, lifelong learning, and managing retirement income. Cognitive health impacts each one of these issues in some way. This trial is a new direction that aligns with current trends in ehealth, and presents a way forward in cognitive assessment.

Professor John McCallum
National Seniors Australia, Director of Research

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1. BACKGROUND

'Better ways of assessing cognitive health' was a project led by Associate Professor Jo Earl from the Flinders Business School and Associate Professor Paul Gerrans from the University of Western Australia with financial support from National Seniors Australia. The project was developed with the aim of examining attitudes to cognitive screening, and the impact of cognitive health on financial decision-making among Australians aged 55 years and over.

On average it takes approximately three years from when symptoms of cognitive decline first appear to disease diagnosis. During this period, active living requires many important decisions, which leaves those with symptoms vulnerable to the adverse impacts of a delay in diagnosis. This is especially risky in occupational roles where a high level of cognitive functioning is assumed (e.g. doctors), when large amounts of money are being managed in organisations or privately (e.g. Self-Managed Superannuation Funds), and when people are making decisions about health treatments, housing, or when to exit the workforce. Early detection is important because people will be better prepared to make choices or adjustments in the early stages of decline before cognition is significantly impaired.

People may also self-limit their behaviour if they believe they have serious cognitive decline even if the reality is they do not. People delay diagnosis of cognitive decline for various reasons: fear of consequences (e.g. removal of a driver's licence); a perception that changes in cognition are a part of the normal ageing process; concerns over being ostracised; or confusion and anxiety about where to go for advice.

The goal of this study was to assess alternative ways for screening of cognitive functioning, and if such screening services were available, whether people would use them, where they would prefer to have the service delivered, and by whom. Attitudes to the assessment of cognitive functioning, sources of information about cognitive decline, and the extent to which others are involved in daily decision-making were also assessed to inform the study aims. Examples of daily decision-making examined included: financial; housing; service providers; health treatments; as well as sources of input into decision-making (family, friends, advisers). We hope to facilitate better access to cognitive assessments which can enable improved self-care/monitoring to allow greater control for the individual. This is consistent with the objectives of Consumer Directed Care (CDC), enabling older Australians to access information on cognitive health status, whether located in the city or regional areas. Reliable, available assessment tools that prevent unnecessary travel and administration costs being incurred (e.g. for specialist neuropsychological assessments) until sufficient evidence has been collected, are required. Longer term, this study has established baseline benchmark data on cognitive functioning where participants have opted into future contact. This provides an excellent base for future work which can leverage this investment to allow monitoring over time and examine the dynamics of cognitive health and decision-making.

2. STUDY OVERVIEW

The study was designed to be delivered in two stages. Stage 1 focused on collecting baseline information, in collaboration with National Seniors and Seniors Card, about the level of interest in, and attraction of, different cognitive assessments' delivery methodologies so as to assess the likely take-up if these were made available. This was achieved by using a preliminary online survey where participants indicated their interest in completing an online cognitive assessment in Stage 2 of the study.

The primary research goal of Stage 2 was to trial a non-intrusive method of data collection using new and sophisticated online technology, CANTAB originating from Cambridge University, to compare objective and subjective self-ratings of cognitive functioning and to assess further interest in on-going assessments.

The 'Identifying better ways of assessing cognitive decline and collecting information about it' survey was distributed online during June and July 2017 (deactivated on July 31, 2017). The online survey was accessed via a direct link distributed electronically through invitations in newsletters and advertisements through organisations including National Seniors Australia's Connect e-magazine, the Seniors Card WeekendPlus online magazine, and through direct email invitation via My Longevity. Additionally, an on-line research provider (PureProfile) provided a panel of participants. Information detailing the purpose of the survey was electronically forwarded to the organisations calling for participants over the age of 55 years to undertake the survey. Participants were invited to participate in Stage 2 of the study at the end of the first survey, with email information and a link to the CANTAB online assessments distributed electronically from June 26, 2017, to the end of July 2017.

3. STAGE 1: ONLINE QUESTIONNAIRE

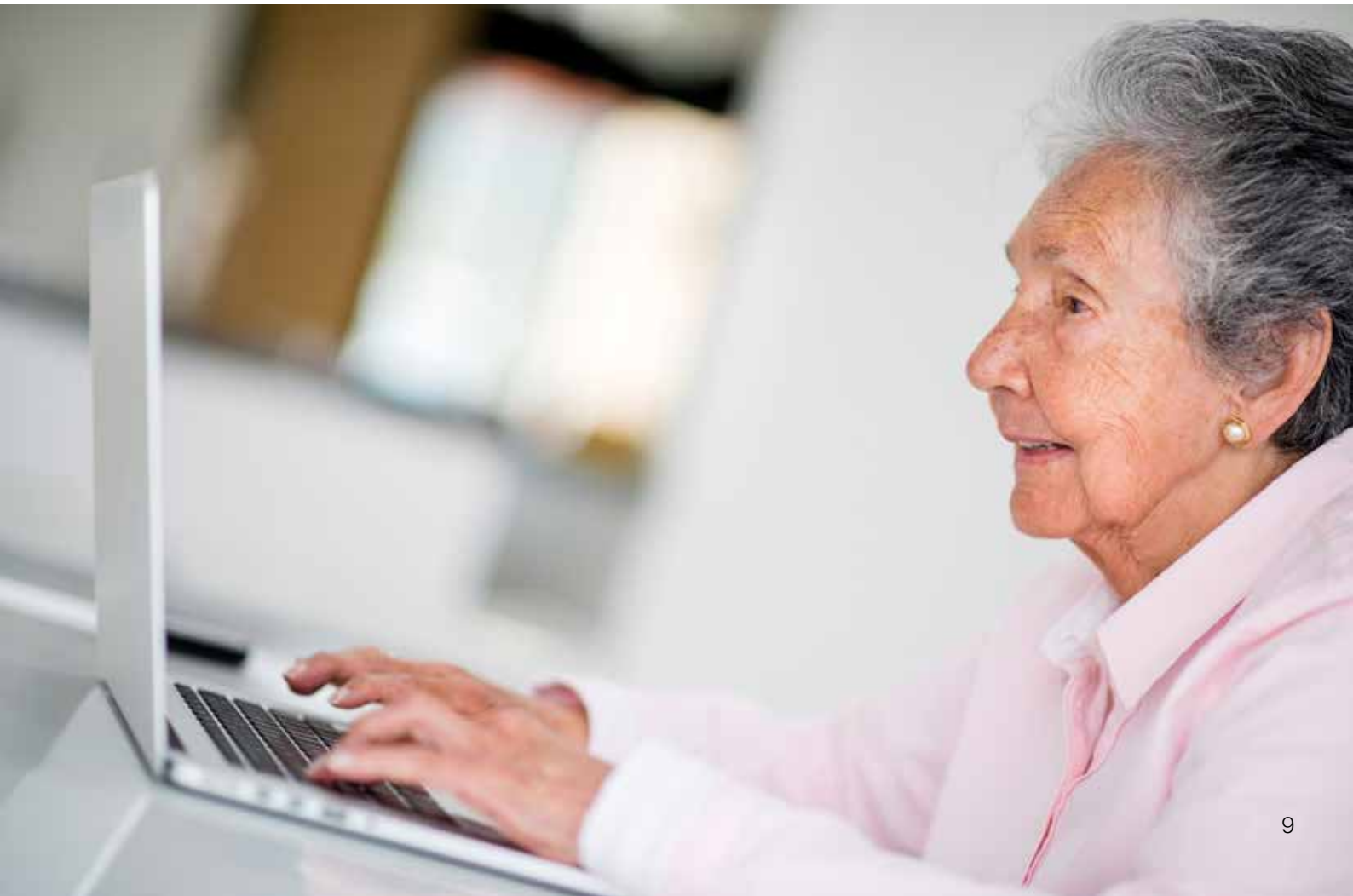
This first section of this report covers Stage 1 of the two-part study.

3.1 Stage 1: Participants

The online survey (Stage 1) was commenced by 547 respondents, with ninety-five per cent of respondents (n =522) agreeing to participate in Stage 2. Of these, eighty-one per cent (n = 444) registered at least once at CANTAB to complete the tests, with 319 completing all three tests and 12 completing one or two tests. Part 1 of this report presents results for all respondents to the Stage 1 survey. Characteristics of the study sample are described below.

3.2 Stage 1: Measures

A copy of the main scales used in the Stage 1 survey is included in Appendix 1, along with a detailed description of these scales in Appendix 2. The Stage 1 questionnaire was designed to collect demographic information, types of decision-making, regular contributors to decision-making processes, timing of retirement, income sources, risk tolerance, decision-making (major purchases, financial, housing, home maintenance, medical treatments etc.), and quality of life. Self-reported aspects of healthy ageing were captured using a multidimensional measure designed to assess cognitive and behavioural domains, day-to-day functioning, and psychological health. The extent to which participants had access to various social and professional resources to support later-life decision-making processes was also evaluated. Attitudes and concerns related to current or potential future cognitive decline were captured via self-report measures, and participant attitudes toward cognitive screening were also considered.



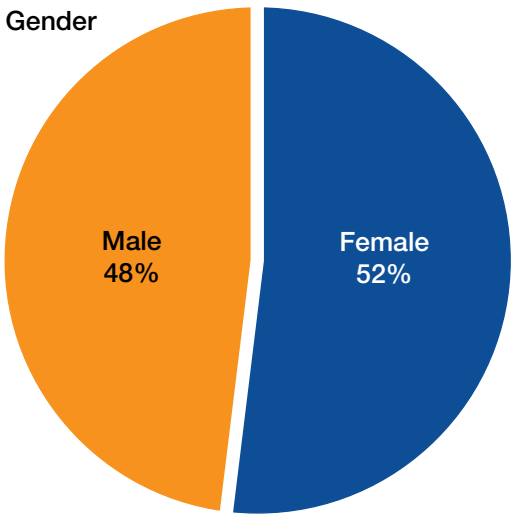
4. RESULTS

4.1 Stage 1: Sample characteristics

4.1.1 Age and gender

As shown in Figure 1, the Stage 1 survey was completed by 283 females (51.7%) and 264 (48.3%) males. The mean age of participants was 68.7 years (SD = 6.92) with a range between 55 and 96 years.

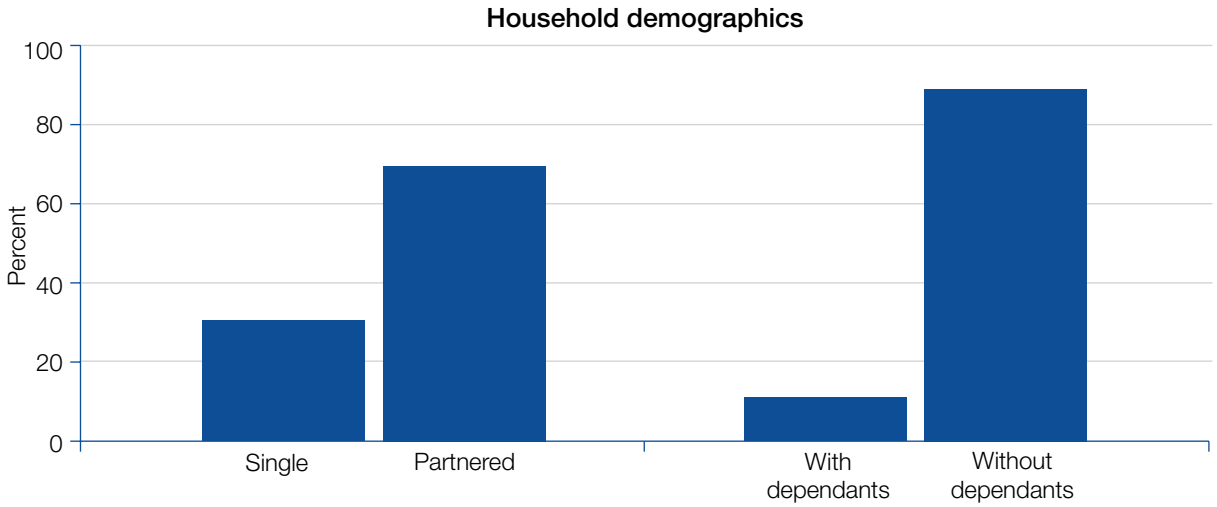
Figure 1: *Gender profile for participants in Stage 1*



4.1.2 Household demographics

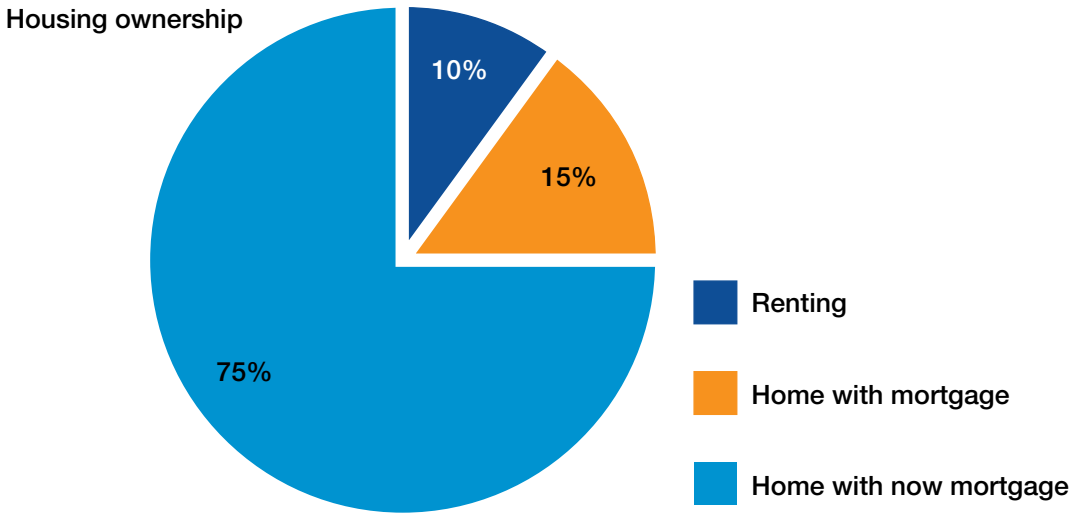
The majority of respondents were partnered (69.5%) with 30.5 percent reporting they were single. Only 11 percent of respondents indicated having dependants.

Figure 2: *Household profile for participants in Stage 1*



Home ownership was reported by the majority (74.8%) of participants, with a further 13.5 percent having a mortgage. Twelve percent of participants were renting accommodation.

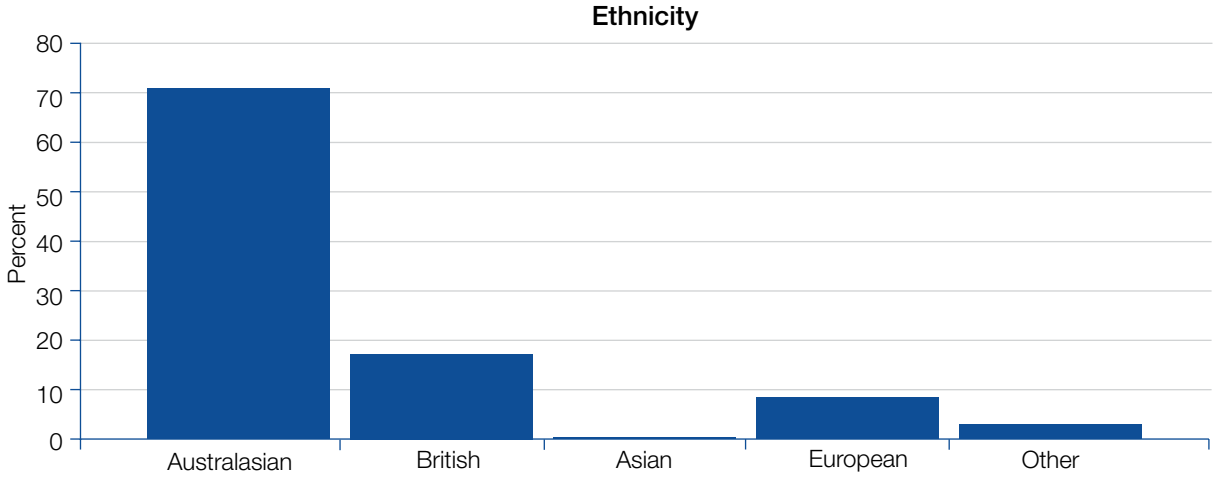
Figure 3: *Breakdown of home ownership for participants in Stage 1*



4.1.3 Ethnicity

Respondents predominantly identified as Australasian (70.8%) followed by British/Irish (17.2%), European (8.4%), Asian (0.4%), and other countries (2.9%).

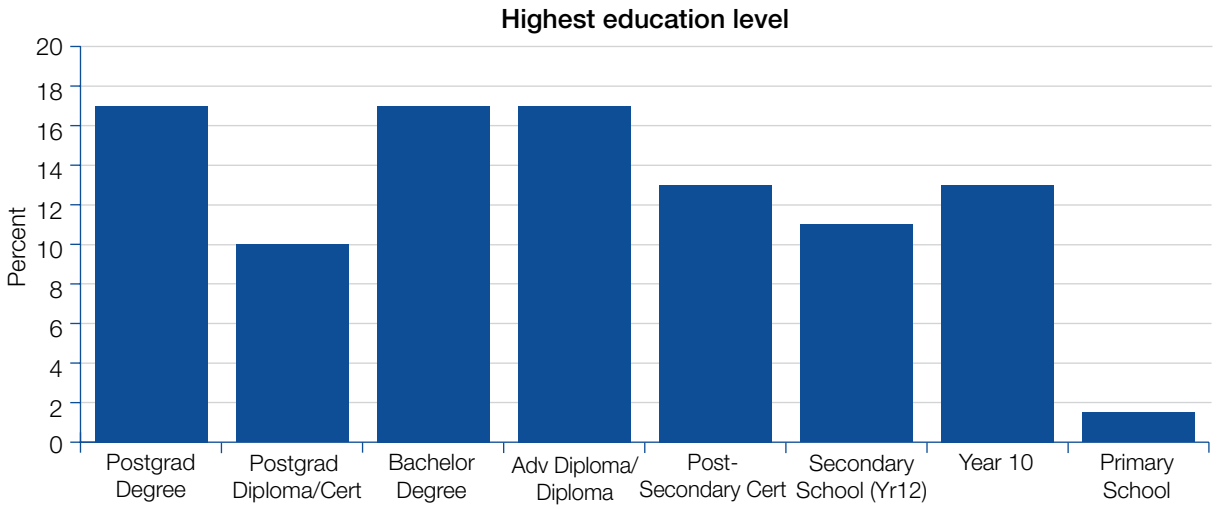
Figure 4: *Ethnic profile of participants in Stage 1*



4.1.4 Highest education level

Twenty-eight percent of respondents had completed a postgraduate degree, postgraduate diploma, or certificate, with a further 17 percent having a bachelor degree. This profile is different to the general population for those 55 years and older where the proportion with a bachelor degree or higher was 21.2 percent in 2015 (HILDA, 2016). Advanced diploma, diploma/certificate qualifications were held by 30 percent, secondary school education was completed by 11 percent, 13 percent completed to Year 10, with only 1.5 percent reporting primary level education.

Figure 5: *Highest education level of participants in Stage 1*

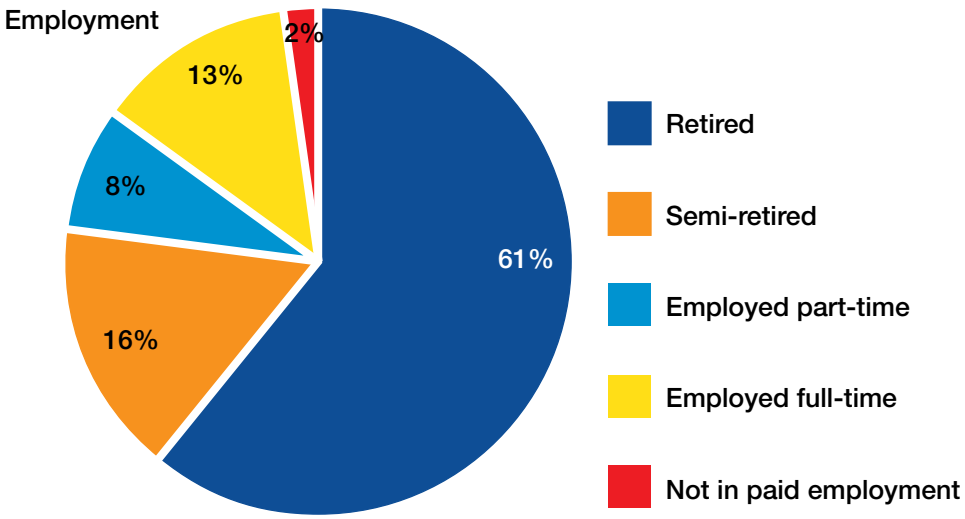


4.1.5 Employment

The majority of respondents were retired (61%) or semi-retired (15%) from the workforce, almost 39 percent of whom had been retired or semi-retired for 10 years or longer (M = 6.37, SD = 3.50).

Being in full-time employment was reported by 13 percent of participants with 7.7 percent in part-time employment, and 2.2 percent not in paid employment. Of those engaged in employment, hours worked per week ranged from 35 hours or more for 35 percent of respondents, between 10 and 34 hours for 44 percent of respondents, with 20 percent working less than 10 hours per week. More than half of those not currently retired indicated they intended to retire at some point in the future (52%), however almost 24 percent did not know if they would retire. Another 12 percent of respondents indicated they never intended to retire. Half (50%) of those in employment expected to be between the ages of 65 and 70 years (inclusive) before their finances would allow them to retire with a further 15 percent reporting this age to be between 75 and 80 years (inclusive).

Figure 6: *Employment status of participants in Stage 1*



4.1.6 Income and net worth

Individual and household gross annual income as reported by participants are shown in Table 1.

Table 1: *Individual and household gross annual income reported by participants in Study 1*

	% of participants	
Gross annual Income ($)	Household	Individual
Less than 25,000	3.9	28.5
25,000 – 49,999	28.2	31.6
50,000 – 74,999	21.1	14.3
75,000 – 99,999	11.6	7.5
100,000 – 124,999	6.8	5.7
125,000 – 149,999	6.8	1.8
150,000 – 174,999	5.0	0.7
175,000 – 199,999	1.3	0.2
200,000 – 224,999	1.1	0.5
225,000 – 249,999	1.6	0.2
250,000 or more	3.4	1.1
Prefer not to say	9.2	7.9

Net worth

Net value of the family home and investment assets as reported by participants are shown in Table 2.

Table 2: *The net value of participant family home and investment assets as reported by participants in Study* 1

	% of participants	
Net Value ($)	Family Home	Investment assets
Don't own	11.3	5.5
Less than 50,000	1.3	9.9
50,000 – 199,999	3.5	14.4
200,000 – 399,999	16.8	13.7
400,000 – 599,999	22.5	9.1
600,000 – 799,999	15.5	7.5
800,000 – 999,999	10.1	5.1
1 mill. – 1.5 mill.	7.3	12.8
More than 1.5 mill.	5.1	10.6
Prefer not to say	6.6	11.3

4.1.7 Comparison of the study sample with the Australian population

A comparison of data from the 2016 Census revealed some key differences in several socio-demographic indicators between the general Australian population and our study sample, presented in Table 3. Overall, the study sample comprised an almost equal ratio of males to females across all age groups. However the ratio of females to males in the 55 to 64 year age group in our study was almost 2:1 compared to an equal gender split in the same age group in the general population. A comparison of the data showed our participants in the 55 to 64 year group to have a higher mean household income compared to the census data despite there being a lower percentage in full-time employment. Our participants also reported a higher percentage of home ownership. The sample differed from the general population in terms of educational qualifications as noted. Overall, our sample was better educated with higher socio-economic status than the comparable Australian population reflecting the constituencies of the organisations from which the sample was drawn. Future research can usefully target those under-represented here including lower socio-economic status and a wider range of ethnic groups.

Table 3: *Comparative data of the Australian population with study sample*

	ABS Data- Australia		Our Study			
	Male	Female	Male	Female	Male	Female
	55–64 years		All participants n = 547		55-64 years n = 147	
Gender split	49%	51%	49%	52%	37%	63%
Mean household income per week	$2,151		$1,633	$1,233	$2,954	$1,992
Home ownership	40.4%	47.3%	75.4	74.2%	66.7%	63.4%
Bachelor degree or higher	22.9%	21.3%	42.4%	47%	70.4%	66.7%
Full-time employment	69.2%	56.3%	13.3%	13.4%	40.7%	34.4%

4.2. Stage 1: Self-reported cognitive functioning

4.2.1 Self-report cognitive measures

Self-reports of cognitive functioning were collected using two main measures: reports of prior diagnosis and exposure, and the Healthy Aging Brain Centre Monitor (HABC: Appendix 2). Briefly the HABC reports activity across four domains (cognitive, functional, behavioural and psychological, and quality of life). Of the 547 respondents in our sample, three people reported having received a diagnosis of dementia (0.5%). Almost 11 percent reported having been a primary care-giver for someone with Alzheimer's Disease (AD), and over half of respondents (57%) reported knowing someone with AD or another type of dementia. Results from the Healthy Aging Brain Centre Monitor (HABC) presented in the survey indicated most respondents scored low levels of symptoms of concern in the four domains assessed (cognitive, functional, behavioural and psychological, and quality of life). Descriptive statistics are presented in Appendix 3, Table 10.

4.2.2 Concerns about cognitive function

When asked about worries in the event they should experience a decline in their cognitive functioning, respondents' primary concern was about family members' concern for their welfare (64%). Fifty-seven percent agreed they would not be able to make decisions properly, nor be responsible for making major financial decisions (57%). The effect cognitive decline would have upon their ability to maintain work and volunteering roles was a concern for 34 percent of respondents as was maintaining the trust of colleagues with respect to decision-making (34%). Results indicated people generally thought friends and social support networks would retain trust in them despite evidence of cognitive decline. Maintaining independence was an issue, with forty-two percent of respondents believing they could not be independent. However, a third believed they could maintain independence, with the remainder undecided as to how a decline in their cognitive function would affect their independence.

Fifty-two percent of respondents indicated they would be embarrassed should they become aware of a decline in cognitive functioning, with 63 percent concerned about how they would react overall, and how they would cope with further assessments (39%). This could be a potential barrier to uptake of community-based cognitive screening and assessment. However, a large proportion of respondents (57%) agreed they would regret not having symptoms checked earlier if cognitive decline is confirmed at some stage. Generally, respondents agreed that GPs would continue to listen to their concerns (64%) and they would be comfortable discussing their cognitive functioning with health professionals (72%).

4.2.3 Decision-making, support networks, and cognitive decline

Those participants with partners were asked to identify who currently takes responsibility for decision-making in four major domains as shown in Table 4. The majority of respondents share decision-making responsibility with their partners, in particular for health, social, and legal decisions.

Table 4: *Responsibility for decision-making*

	Always me (%)	Usually me (%)	Shared equally (%)	Usually partner (%)	Always partner (%)
Financial	18.2	19.9	32.7	2.9	1.3
Health	9.7	19.2	68.7	1.3	1.1
Social	7.1	18.4	65.3	8.9	0.3
Legal	11.8	22.9	62.4	2.4	0.5

Participants were then asked to consider who they would approach for assistance with decision-making should they suspect a decline in cognitive health. Respondents indicated people available to help when making important decisions to include partners (67%), daughters/sons (66%), and friends (65%). Interestingly, other family members (22%) and brothers/sisters (36%) were not as readily available to assist in major decision-making.

4.2.4 Sources of information

Respondents were asked to consider all of those from whom they would likely seek advice should they have a decline in their cognitive functioning. Participants reported they would be likely/extremely likely to seek advice from their partner (84%), their GP (72%), friends (49%), and children (53%). Seventy-four percent indicated they would access advice online but only 16 percent felt they would utilise phone/helpline services. A minority of our sample (18%) indicated they would delay seeking advice as long as possible, with 10 percent suggesting it would be likely/extremely likely that they would not seek help.

4.2.5 Attitudes to cognitive assessment

A major aim of this study was to assess the level of interest in, and attraction of, different methods of cognitive assessment delivery methodologies. Participants were asked their preferences regarding type of assessment, location of delivery, and cost of assessments. Less than three percent of those sampled indicated that they wouldn't like to do any assessment. The majority (54%) indicated a preference for computer or tablet-based assessments over pencil and paper assessments (9.9%), with a third indicating no preference. Of those with an interest in an assessment, the majority would prefer to complete assessments at home (74%: Table 6) or with the local GP (19.8%: Table 6). Of those with an interest in an assessment, 39 percent were prepared to pay between $10 and $50 per assessment, with another 39 percent prepared to only undertake assessments if covered by Medicare or health insurance.

Table 5: *Participant attitudes to cognitive assessment methodologies*

What type of assessment would you prefer?	% (n = 547)
None, I wouldn't like to do any monitoring or assessment	2.9
A pencil and paper type assessment	9.9
A computer tablet or iPad based assessment	54.3
No preference	32.9

Table 6: *Preferred location of future cognitive assessments*

Where would you most prefer to complete an assessment?	% (n = 530)
Local GP	19.8
At home	73.8
At home with a Community Nurse	3.6
Psychologist	2.8

Many aspects of financial management at older age assume good cognitive health. There are many decisions to be made about investments, superannuation, housing options, pension eligibility and tax implications. The decumulation phase is often more complex than accumulation because, without income replacement, decisions can have long term consequences. A decline in cognitive health may have serious implications in terms of financial losses but also leave people more vulnerable to financial abuse. The relationship between financial decision-making and cognitive health is yet to be fully explored. Section 4.3 of the report outlines the base levels of the financial measures; and Section 5, the cognitive measures. These results are then integrated to explore the relationship between the two sets of measures (Section 6). We also explore self-ratings to determine whether these might be appropriate proxies for objective measures in the future.

There are several financial measures reported in the next section. These are outlined in detail in Appendix 1 (items 1 – 4) and in Appendix 2. Briefly these are:

Financial literacy – measuring basic and advanced understanding of financial concepts;

Applied financial literacy – measuring application of rules relating to superannuation and pension implications;

Financial wellbeing – measuring wellbeing and the influence of finances;

Financial risk-taking – measuring how willing people are to take risks with investments;

Subjective financial ability – predicting the number of financial literacy items answered correctly.

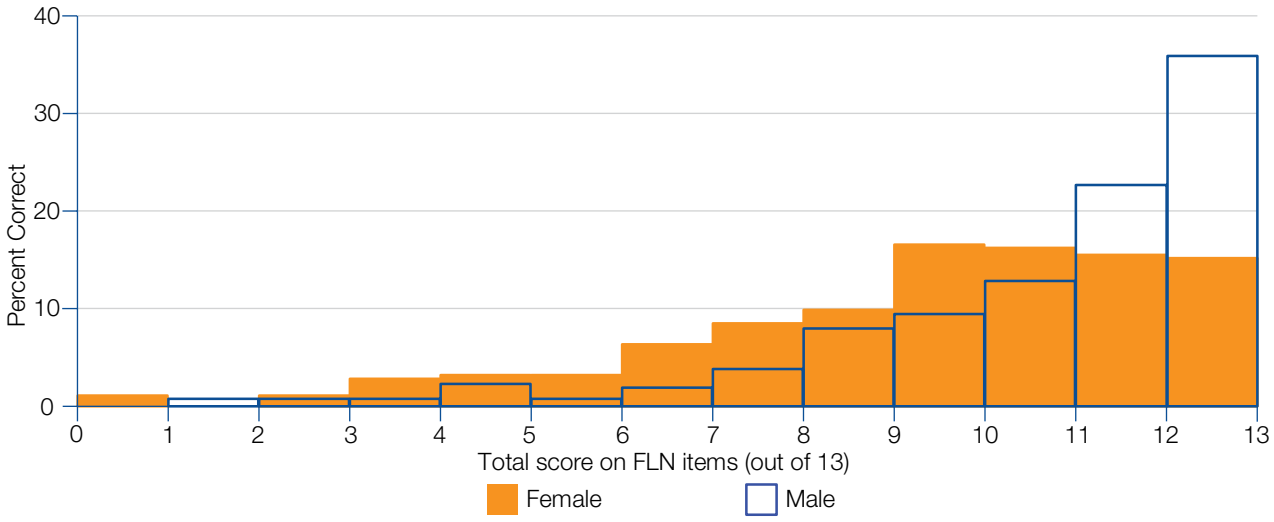
4.3 Financial literacy and financial wellbeing

As outlined, respondents' financial literacy was assessed using both objective and self-reported measures. See Appendix 1 for items, and Appendix 2 for a description of the measures used.

4.3.1 Financial literacy

Figure 7 presents distribution of scores for the 13-item scale, developed by Fernandes, et al. (2014), for the overall sample and by gender. It shows that the median number of correct answers overall is 10, though a clear gender difference is evident with a median for males of 11 and for females 9 (means 10.3 and 8.9 respectively, t-test 6.40 , p-value <0.01). The number of answers respondents thought they had correct was compared to those actually correct. This indicated that males are overconfident (average 0.4 questions) in their ratings of financial literacy, and these results are significantly different to zero (t-test 2.58 p-value 0.01), while females marginally underestimated their scores (-0.11), but these are not significantly different to zero (t-test 0.72, p-value 0.47). Males' confidence scores are significantly higher than female respondents (t-test 2.28, p-value 0.02).

Figure 7: *Distribution of scores by gender for financial literacy*

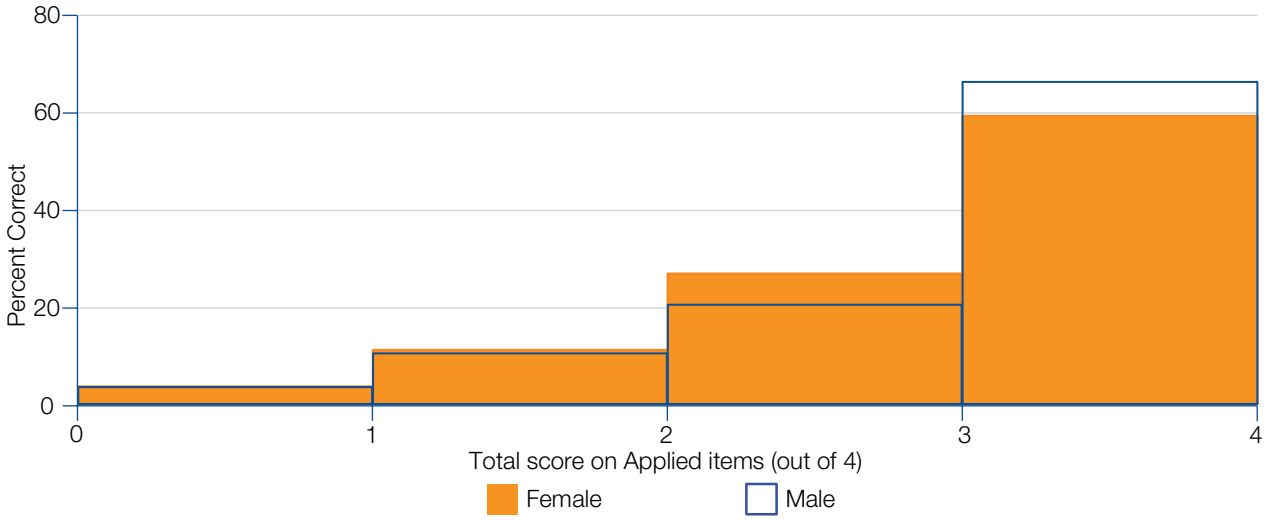


4.3.2 Applied financial literacy

Four questions were used to measure applied financial literacy across management of financial assets (credit cards), superannuation and the age pension (Earl, Gerrans, Asher, & Woodside, 2015). For example, whether there is any guarantee on investments in superannuation, and a question related to the pension means test. Again, participants were asked to report their confidence in the number of correctly answered questions. See Appendix 2 for a description of the measure, and for the scale see Appendix 1.

Figure 8 presents the distribution of the number correct overall and by gender. The median score is three overall, and by gender with a small mean score difference for males and females (2.8 versus 2.6 respectively), which is significant (t-test 1.59, p-value <0 .01). As with the 13-item measure, males were overconfident, predicting they had more answers correct than they actually did (0.4), which is significantly different to zero (t-test 4.86, p-value <0.01). Females were again marginally underconfident (-0.01), which is not significantly different to zero (t-test 0.05 p-value 0.96). The difference in confidence scores is significant by gender (t-test 3.64 p-value <0.01).

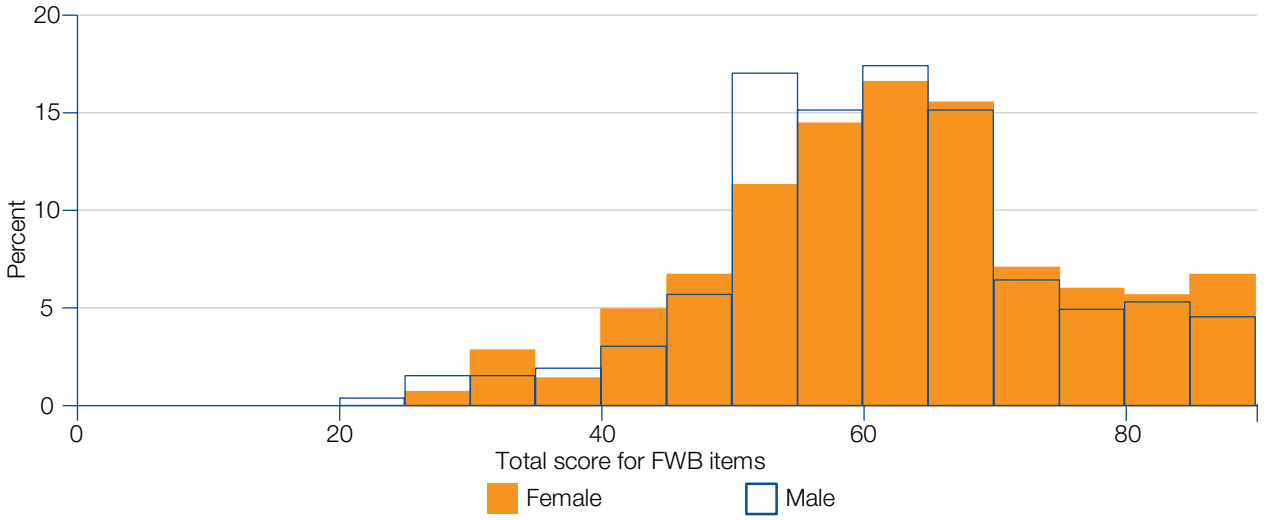
Figure 8: *Distribution of scores by gender for applied financial literacy*



4.3.3 Financial wellbeing

Financial wellbeing was assessed using the 5-item abbreviated scale developed by the US Center for Financial Protection Bureau (CFPB, 2015). Figure 9 presents the distribution of financial wellbeing scores. The mean overall score was 61.4 with significant difference by gender. See Appendix 2 for a description of the measure and items 1.1 and 1.2 in Appendix 1.

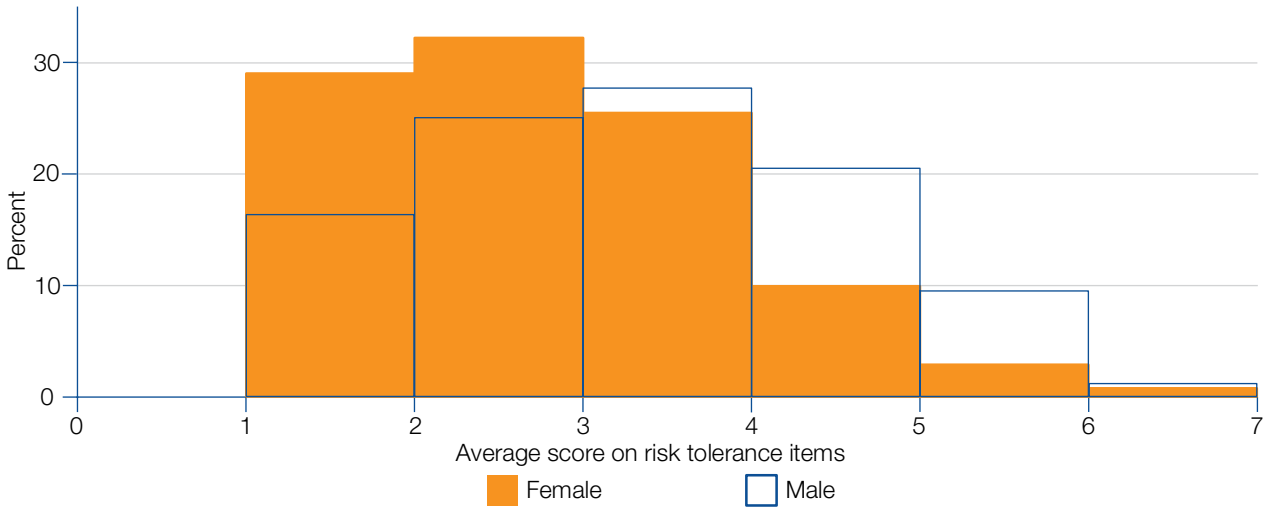
Figure 9: *Distribution of scores by gender for financial wellbeing*



4.3.4 Financial risk tolerance

Measured using a 5-item scale (Jacobs-Lawson & Hershey, 2005). See Appendix 2 for a description of the measure and question 2.1 in Appendix 1. Figure 10 indicates that males' risk tolerance is significantly higher than females (3.2 versus 2.6, t-test 6.27, p-value <0.01), notwithstanding that males in the sample are two years older.

Figure 10: *Distribution of scores by gender for financial risk tolerance*



4.3.5 Subjective financial ability

Participants were asked to self-assess their ability in four related domains: ability to make everyday financial decision-making; investing knowledge; superannuation knowledge; and maths ability.

Participants in our sample generally self-reported good financial literacy. They rated their knowledge of investing in financial assets such as stocks and bonds as good (M = 4.48, SD = 1.62, range 1 – 7 where 1 is extremely poor and 7 is extremely good). Similar self-reports were recorded for knowledge of superannuation and retirement investment income products (M = 4.81, SD = 1.61), and ability to make changes to superannuation or retirement income (M = 4.94, SD = 1.71), with slightly higher confidence reported for ability to make day to day financial decisions (M = 6.02, SD = 1.08).

Figure 11 provides a breakdown of the mean self-assessments by the number of questions correct in the objective 13-item scale. The figure indicates that for females, the self-assessed ability to make day-to-day financial decisions is largely invariant to the score on the objective scale. For males, there is some suggestion that those scoring lower on the objective measure also rate themselves lower on ability to make day-to-day financial decisions though there are small numbers in these groups. For scores between six and thirteen on the objective scale there is a positive trend in each of the other self-assessments.

Figure 11: *Mean scores by gender for subjective and objective financial literacy*

Section 5 of the report focuses on measures of cognition collected during Stage 2 of the project followed by Section 6 where these are integrated with the financial measures. There were three major aims to these sections. The first was to examine the relationship between subjective and objective levels of cognition to examine the extent to which older adults were aware of their level of cognitive health. The second was to examine financial literacy and decision-making processes in older adults and the relationship of these constructs to subjective and objective levels of cognition. Third, to investigate attitudes to alternative cognitive screening methodologies in older populations.

5. STAGE 2: CANTAB COGNITIVE ASSESSMENT

To examine the interrelationships between constructs of interest, we first assessed correlations of key variables of interest, and second estimated hierarchical multiple regression analyses (see Cohen, Cohen, West, & Aiken, 2013). The correlation and regression analyses show the degree of association between variables, for example, whether we can investigate if those with lower levels of cognitive function have lower scores on financial measures. Here we focused on associations between subjective and objective measures of cognitive function as predictors of i) financial literacy, ii) financial wellbeing, and iii) financial risk tolerance. As the data is cross-sectional we do not investigate causality in these estimations.

Tests of multivariate analysis of variance (MANOVA) were also included, to examine whether cognitive function was associated with i) people's decision-making processes, ii) engagement with sources of advice and support, and iii) with the type of relationship they were in. We also analysed whether the preferred type of cognitive assessment related to level of cognitive function.

To summarise, the analyses that follow will address the following questions:

I. How accurately do individuals assess their own level of cognition?

II. What association is there between the self-report HABC measures and the objective CANTAB assessments?

III. Are associations between HABC and CANTAB assessments robust to controls, notably for the age and level of education?

IV. What relationship is observed between both self-assessed and objective measures of cognitive function and financial literacy?

V. Is the propensity to engage others to seek advice, and to engage with services, associated with cognitive assessments?

VI. How does relationship status correlate with cognitive assessments?

VII. What is the level of interest in alternative types and location of cognitive assessments and to what extent is this price sensitive?

VIII. Is the interest in cognitive assessment, and type and location, associated with subjective and cognitive assessment scores?

The following section provides descriptive information on the measures that were a focus of our analyses before summarizing the main findings addressing the research questions.

5.1 CANTAB assessments

The CANTAB online assessments provided objective measures of cognitive function and provided information as to how participants manage and respond to the delivery of computer and tablet-based online cognitive screening. These offer a form of digital technologies and innovation monitoring similar to those reported in the National Seniors report on CDC.

The assessments were conducted over June and July 2017, generally two weeks after the participant had completed the Stage 1 survey. A dedicated email Helpline was established at Flinders University to assist participants with queries or technical difficulties in accessing or completing the CANTAB assessments.

The CANTAB assessments were developed by Cambridge Cognition. Cambridge Cognition developed the software for CANTAB Connect Research which provides validated measures of cognition. We utilised three of the tests assessing different areas of cognitive function, namely: attention and psychomotor speed; executive function; and memory.

The tests are delivered online and appear similar to games, and can be completed on a computer or iPad/ tablet device. The largely non-verbal nature of the assessments makes them accessible to people from non-English speaking backgrounds. A large volume of research has been published reporting the sensitivity of these measures in detecting small, but significant, changes in cognition (Cambridge Cognition Ltd, 2017).

The present study allows establishment of baseline assessments and a basis for longitudinal analysis as participants were asked if they would like to be contacted in 12 months' time to retake the assessments. This will allow analysis of cognitive change and decision-making change over time as well as providing a natural means of validating participant willingness to participate in longer term online cognitive screening.

The three assessments used were:

- **Paired Associates Learning (PAL)** takes eight minutes to complete and targets visual episodic memory and new learning;
- **Spatial Working Memory (SWMBE)** measures visuospatial working memory and executive function and requires approximately 5 minutes for completion; and
- **Information Processing (RVPA)** which assesses sustained attention and processing speed and takes approximately nine minutes to complete.

A further description of each of the measures, including examples of screen shots from the tests, are provided in Appendix 3. Detailed information can be found at Cambridge Cognition (2017).

In Section 6 of the report the cognitive measures collected in Stage 2 are combined with the financial and self-rating measures collected in Stage 1. The relationship between subjective vs. objective cognitive measures are reported along with the relationship between cognitive and financial measures. Levels of cognition are compared across engagement with advice sources, relationship status, and preferences for assessment delivery.

6. RESULTS: INTEGRATING STUDY 1 AND STUDY 2 DATA

6.1 Demographic and descriptive measures

Stage 1 of the study was completed by 547 participants, with 95 percent indicating an interest in participating in Stage 2, involving the tests. Those expressing an interest were emailed with further information about the tests, plus compatibility requirements. While the tests can be completed online, to date they have been validated on certain hardware (iPad, PC, laptop, tablets), and perhaps more importantly, via either an application (on iPad) or certain browsers (Safari, Edge, Chrome). Of the 522 who had expressed an interest, 78 (14.9 percent) did not respond to the email invitation for Stage 2. Of the remaining, 113 followed through and were 'registered' at CANTAB website but were either unable (due to incompatible device or browser) or not interested to continue and complete the tests. The remaining 331 completed at least one of the three tests, and 319 completed all three tests.

Before investigating the Stage 2 data, the characteristics of four groupings of Stage 1 and Stage 2 participants was examined to assess any sample selection issues. Four groups were constructed: those who indicated they did not want to participate in Stage 2 (n=25); those who indicated they wanted to participate but did not respond to the follow-up email invitation (n=78); those who responded to the Stage 2 email but did not complete any CANTAB tests (n=113); and those who responded and completed the tests (n=331). A multinomial logit was estimated which included the participant's age, gender, education, household status, and the HABC total score. None of the characteristics were significant[2] in predicting either registering for or completing CANTAB tests in Stage 2.

The mean age of the 331 participants who completed one or more assessments at CANTAB was 68.7 years (SD = 6.8, Range = 55 to 87). The gender breakdown was even (males 49.2%), with 70 percent being in a partnered relationship and 30 percent single.

The overall mean scores for the CANTAB assessments are presented in Table 7. Note that the PAL and SWMBE are negatively scored in the sense that a higher number represents a larger number of errors and a poorer score. The RVPA score is positively scored from zero representing a 'bad' score and one a 'good' score. There was a significant difference between PAL scores by gender with males making more errors than females. There was no significant difference for the two other measures. In the sample, the average age of males is approximately two years older than females. The correlation of age with each score suggests age is positively associated with a higher number of errors on the PAL (r = .26, p <0.01), errors on the SWMBE tasks (r = .32, p = <0.001), and poorer performance on the RVPA (r = -.25, p <0.01), reflected in a lower *hit* to *miss* ratio as age increases.

Table 7: *Mean scores for the CANTAB assessments*

	N	Minimum	Maximum	Mean	Std.Deviation
PALTEA6	329	0	20	5.77	5.79
SWMBE	327	0	32	14.21	8.62
RVPA	309	0	1	.90	.05

6.2 Direct associations between subjective and objective cognitive measures

As a first step in our analysis, we examined whether participants' subjective assessments were associated with the objective assessments. Subjective scores on each of the sub-scales of the HABC monitor were first correlated with the objective cognitive measures obtained on the CANTAB assessment battery.

Estimated correlations (see Appendix 4, Table 12 for details) show that self-report measures on the HABC cognitive, behavioural and psychological, or quality of life domains were not significantly associated with objective levels of cognitive function. Self-report measures on the functional sub-scale had a negative correlation with scores on the RVPA ($r = -.14$, $p = .015$), suggesting that those reporting more symptoms in the functional domain did not do as well at detecting target sequences. The latter result suggests that when respondents identify problems themselves in the functional domain, this correlates with objective measures of sustained attention and processing speed.

To further investigate the associations, regression analysis was undertaken with each of the scores on the three cognitive measures (PAL, RVPA, and SWMBE) in turn, as the outcome, and the four domains of the HABC monitor and gender, as explanatory variables. Results are presented in Appendix 5, Tables 13, 14 and 15. Having identified a significant association between education and objective measures of cognitive function, the next step was to estimate a series of regression analyses to assess the contribution education made to a person's overall performance. The regression models were specified in three steps. Gender and age were entered in the model at Step 1 and highest education level in Step 2. The four HABC domain measures were entered as predictor variables at Step 3. We consolidated the highest education categories into five categories (Year 10; secondary; diploma or post-secondary certificate; bachelor degree; postgraduate). Separate models were considered for each of the cognitive outcome measures.

For PAL scores, while scores are marginally higher for males, the significant difference previously noted is no longer observed when age is controlled for in the first step. Age is positively and significantly associated with number of PAL errors. A one standard deviation increase in age is associated with a 0.20 increase in the standardized PAL error count. When education is added in the next step, results suggest that those in lowest education category (highest Year 10) make more errors relative to a postgraduate qualified respondent, however this is a weakly significant result (90% confidence level). Adding education in step 2 does not improve the overall model fit (R2 change 0.014, $F(4,322) = 1.17$ $p = 0.324$). Age remains significant and positive when education is controlled for. When self-reported scores on the HABC domains are added in step 3, there is no significant improvement in model fit, and none of the scores are significant.

The same estimation with the RVPA score provides similar results. There is no significant difference by gender and RVPA scores reduce with age. A one standard deviation increase in age is associated with a 0.20 reduction (deterioration) in the standardised RVPA score. Education level follows a similar pattern to PAL with weak (90% confidence level) but significant results: those with either Year 10 or Year 12, post-secondary certificate as the highest education level have poorer performance relative to those with a postgraduate qualification. Adding education is informative but overall weak (R^2 change 0.021, $F(4,302) = 1.94$ $p = 0.105$). When the HABC domain scores are added in step 3, the functional score is significant with those reporting more symptoms in the functional domain having poorer scores. A one standard deviation increase in the functioning score is associated with a 0.19 drop in the standardized RVPA score.

Next the SWMBE score was examined. The results again suggest no difference by gender but a significant age relationship. A one standard deviation increase in age is associated with an increase in the standardised SWMBE error scores. Relative to those with a postgraduate qualification, those with Year 10 as their highest make more errors (3.69), and those with diploma or advanced diploma (2.47). Adding highest education level improves the model overall (0.023 $F(4,320)$ 2.068, $p = 0.085$). When scores on the HABC domains are added in step 3, higher scores on the HABC psychological scores are positively and significantly related to the number of errors. A one standard deviation increase in HABC psychological score is associated with 0.14 increase in the standardised score.

Results from this preliminary analysis identifies an expected significant negative age relationship with each of the CANTAB test scores. Education appears significant, but generally for those with postgraduate qualifications as their highest education level. Education may buttress declines in cognitive health into older age. Conversely, older adults with lower levels of education may be at higher risk of decline in cognitive function with adverse implications for decision-making, financial wellbeing, and wellbeing into retirement. Further research can usefully examine more closely the moderating relationship of education on age-related declines. Longitudinal data would allow investigation of whether, for example, the age at which age-related decline is first observed is deferred for those with higher levels of education or whether the rate of decline is reduced for those with higher levels of education.

6.3 Cognition and financial literacy

A review of the literature generally demonstrates that financial sufficiency is a protective mechanism in the process of ageing well. Financial strain can be exacerbated through multiple mechanisms, including early retirement or forced redundancy, the erosion of savings and superannuation due to external events (e.g. the global financial crisis), and poor financial decision-making. At present, 88 percent of people aged 65 years plus are not involved in the workforce (Australian Bureau of Statistics, 2011). Despite a trend toward later retirement and a move toward transitioning into retirement, the effective age of labour market exit in Australia in 2014 was 62.9 years for women, and 64.0 years for men (OECD, 2017). Women can therefore expect to live 24.2 years in retirement, and men, 19.3 years. Age-dependency ratios continue to reflect the ageing population pressure on aged pension payments. Similar pressures on other age-dependent expenditures for government (e.g. health and aged-care) are expected to place greater significance on accumulated personal savings and the financial decisions associated with them.

Financial sufficiency is an important mechanism in supporting ageing well, demonstrated by higher levels of income and net worth being associated with higher levels of wellbeing in older age (Islam, Wills-Herrera, & Hamilton, 2009). Financial strain and insufficient income to meet basic needs are associated with negative outcomes in multiple domains. Financial strain increases vulnerability to environmental conditions, for instance reduced access to health care (Walsh, 2012), in turn increasing risk of serious illness and disability, and early mortality. Higher levels of socio-economic status (SES) are associated with higher levels of education, income, occupational status, and providing wider opportunity for participation and engagement in activities (Walsh, 2012), the latter being protective factors in relation to maintenance of cognitive function. Better access to health care, services, and formal support are also afforded by higher SES, supporting older adults to age in place (Ziersch, Baum, MacDougall, & Putland, 2005).

Given research points to income as a protective factor in coping in older age, the importance of financial literacy and the maintenance of competent financial decision-making during later years were addressed in this study. We examined whether better cognitive health was associated with better overall financial literacy and financial wellbeing in older age. To address this question, we first analysed the relationship between subjective levels of cognition with four financial measures, namely financial literacy, applied financial literacy, financial risk tolerance, and financial wellbeing.

A preliminary bivariate analysis suggests significant correlations between the subjective HABC Monitor scores, financial literacy, and financial wellbeing. Each of the HABC domain scores are negatively and significantly associated with the comprehensive (FLN) financial literacy scale ranging from -0.10 ($p<0.05$) for the HABC quality of life domain score to -0.15 ($p<0.01$) for the HABC functional score. Similar magnitude correlations are observed for the applied financial literacy measure with the exception being for the cognitive score, which was not significant. Each of the HABC domain scores are negatively and significantly associated with financial wellbeing. The HABC behavioural and psychological domain scores as well as the HABC quality of life score had the strongest correlations with financial wellbeing (-0.32 $p < .01$, and -0.36 $p<0.01$ respectively). HABC cognitive and functional domain scores are also negatively and significantly related to financial wellbeing (-0.13 $p<0.01$, and -0.18 $p<0.01$ respectively).

Given the significant correlations estimated between subjective cognitive function and financial literacy, we next explored the relationship between objective cognition levels and financial ability. A series of regression analyses were undertaken, specified in two steps. The covariates of gender, age, and education were entered in the model at Step 1, with the three CANTAB scores entered separately in Step 2. Separate models were considered for each of the cognitive outcome measures (i.e. PAL, RVPA, and SWMBE). Results are presented in Appendix 5, Table 16.

The estimations identify a significant gender effect for both financial literacy measures, with males having significantly higher scores. Age is significantly negatively associated with FLN measure but not significant for the applied measure. Relative to the postgraduate base category, each lower education level excluding the bachelor qualification, is significantly lower for the FLN measure but not significant for the applied measure. In Panel A when the PAL score is included in step 2 it was significant and negative for the applied measure but not the FLN measure. In the applied measure, a one standard deviation change in PAL score is associated with a 0.12 reduction in the standardised applied score. When the RVPA score is used (Panel B), it is significant and positive for FLN but not for the applied measure. A one standard deviation change in RVPA score is associated with a 0.22 higher standardised applied score. When the SWMBE score is used (Panel C), it was significant and negatively related to both financial literacy scores with a -0.20 and -0.12 reduction in the standardised FLN and applied measures respectively, given a one-standard deviation change in SWMBE score. The results from these analyses support previous research showing financial literacy to be associated with level of education and level of subjective cognitive function (Earl, Gerrans, Asher, & Woodside, 2015). Here the result when objective measures are used was largely consistent but not robust across the financial literacy scale.

The results when risk tolerance is used as the dependent variable replicate the gender and age results for financial literacy. Financial risk tolerance is significantly higher for males, significantly negatively related to age, and significantly lower for those with lower highest education levels relative to those with a postgraduate qualification. None of the CANTAB scores were significant.

When financial wellbeing is the dependent variable the results are a mixture of the results discussed. There is no gender effect but now age was significant and positive. For example, a one-standard deviation increase in age was associated with a 0.14 increase in the standardised wellbeing score. As for the other dependent variables, lower levels of education had significantly lower financial wellbeing scores than those with a postgraduate qualification. In terms of the CANTAB scores, neither the PAL or SWMBE scores were significant. However, RVPA scores were significant and positive. A one-standard deviation improvement in RVPA scores had a 0.096 increase in financial wellbeing.

In summary, significant associations were found between applied financial literacy and PAL, comprehensive financial literacy, RVPA and SWMBE. SWMBE was negatively related to financial wellbeing, though modestly. A caution is warranted here particularly for the financial literacy results. As estimated, the implicit assumption is that poorer CANTAB scores are predictive of poorer financial literacy scores. However, poorer financial literacy scores could well be a leading indicator of poorer CANTAB scores. This question can only be clarified with longitudinal data and cross-lagged panel analysis.

6.4 Engagement with sources of advice and cognition

Social networks and other social support resources available to an individual are major contributors to wellbeing, and physical and cognitive health in older age. Research consistently shows social support to be associated with better levels of wellbeing in times of challenge and stress (Netuveli & Blane, 2008) (Schum, Briggs-Phillips, & Hobfoll, 2006) and with slower rates of cognitive decline in older populations (James, Wilson, Barnes, & Bennett, 2011). Social support was defined in the General Social Survey (Australian Bureau of Statistics, 2011) as a person's ability to ask for small favours or help in a time of crisis. More broadly, social support may take the form of emotional, informational, or instrumental support, and be sought from formal or informal social networks. Social support networks in terms of their number and proximity have the potential to contribute to coping in face

of change and challenge. Social support, be it formal or informal, that is timely and accessible supports people as they age, and in coping with losses and limitations that accompany ageing.

As an important resource, we asked participants to indicate the likelihood of seeking advice from differing sources should they need help with decision-making if they had a decline in cognitive functioning. A range of different sources were listed, including proximal and informal sources (i.e. partners, children, other family members, and friends), and more distal and formal sources of support, such as a GP and online searches. Participants could also indicate if they would be unlikely to seek support from any source. Questions were answered on a 5-point scale anchored from extremely unlikely (1) to extremely likely (5) to seek help and advice from that source. Results were stratified into three groups: Group 1 (extremely unlikely and unlikely); Group 2 (neither unlikely nor likely); and Group 3 (extremely likely and likely).

On average, participants are likely or extremely likely to seek advice from no more than 4 different sources (M = 3.78, SD = 1.59). The number of sources of support is associated with performance on the PAL (r = -.162, p = .05), suggesting that lower levels of objectively measured cognition (i.e. a higher number of overall errors on the PAL) is associated with a person seeking advice from fewer sources of support. We then examined what sources of support were more likely to be accessed. The percentages of people seeking advice from each source are displayed in Table 8. As can be seen, for informal support, participants are most likely to seek support from proximal sources such as their partner and children, followed by friends. They are least likely to approach more distal informal sources such as other family members. Over two-thirds of our participants were agreeable to seeking support from formal distal sources, such as their GP, and from informal distal sources, such as online resources. There were no significant differences between males and females as to their reported support network.

Table 8: *Likelihood of seeking advice and help from different sources*

	Source of Advice													
Group	Partner %		Other family %		Children %		Friends %		Doctor %		Online %		None %	
	F	M	F	M	F	M	F	M	F	M	F	M	F	M
0	10.6	5.0	42.3	47.7	16	21.5	19	27	11.4	10	11	12.4	63.7	68.8
1	8.2	5.4	19.4	22.1	15.2	22.3	28	23.4	17.7	12.4	12.5	11.2	25.9	18.6
2	81.2	89.6	38.3	30.2	68.8	56.2	53	49.6	70.8	77.6	76.5	76	10.4	12.7

Note: Group 0 = Extremely unlikely/Unlikely to seek advice from this source; Group 1 = Neither unlikely or likely to seek advice from this source: Group 2 = Extremely likely/Likely to seek advice from this source

Of interest in this study was the relationship between cognitive health and a person's engagement with support networks. To examine whether people with lower scores on cognition engaged more or less with a range of advice sources, we conducted a series of MANOVA analyses (results of the models are presented in Table 17, Appendix 6), with likelihood of seeking advice (group 0, 1, or 2) as the grouping variable, and dependent variables of subjective cognition (HABC cognitive), objective measures of cognition (PAL, RVPA, and SWMBE scores), and scores on financial literacy and applied financial literacy.

Overall, there are significant differences between the three groups on the models analysed for advice sources of partner, children, GP, online, and none. A summary of our findings follows:

- **Advice from Partner**
  Overall the results suggest there is a difference between the three groups on the combined measures of cognition and financial literacy. When the dependent variables are considered separately, the scores on the PAL reached statistical significance, F (2,209) =5.60, p=.004, partial η^2=.051. The mean scores for those unlikely to consult their partner (M=9.31, SD=1.38) are higher than for those neither likely nor unlikely (M=7.39, SD=1.53) and for those likely (M=4.92, SD=.41). Results indicate that participants with lower cognitive scores (i.e. a higher mean number of errors on the assessment) were more **unlikely** to consult their partner for advice.

- **Advice from children**
  The results show the overall model as statistically significant. This was driven by differences between the groups for scores on the RVPA, F (2,254) =3.85, p=.02, partial η^2=.029. Mean scores indicate poorer performance on the RVPA for the unlikely group M=.885 (SD=.007) and neutral group M=.897 (SD=.007), compared with better performance for the likely group M=.907 (SD=.004).

- **Advice from GP**
  The overall model is statistically significant with differences between the groups for scores on the PAL, F (2,294) =6.77, p=.001, partial η^2=.044. Mean scores are, for the unlikely group M=8.17 (SD=6.23), neutral group M=3.53 (SD=5.02), and the likely group M=5.53 (SD=5.42). The participants recording lower levels of cognition on the PAL (i.e. a higher number of mean errors) are less likely to consult their GP for advice.

- **Advice online**
  This model also reached overall statistical significance. There are significant differences, F (2,295) =6.67, p=.001, partial η^2=.043 between the groups on their financial literacy scores, mean scores for the unlikely group M=.239 (SD=.142), neutral group M=-.275 (SD=.139), and likely group M=.269 (SD=.056). Subjective cognitive level also differs between groups, F (2,295) =3.67, p=.027, partial η^2=.024. The mean score for the unlikely group is M=.486 (SD=.276), for the neutral group M=1.162 (SD=.268), and for the likely group M=1.28 (SD=.108). Participants reporting poorer subjective cognitive function are more likely to seek advice from online resources. This finding could reflect a reluctance to concern family and friends about possible declines in cognitive function. However, those with lower perceived levels of cognitive function may be well-suited to the uptake of online assessment methodologies such as those trialled in this study.

- **No Advice**
  This model was statistically significant with two dependent variables showing differences between the three groups of advice seekers. Those with lower mean financial literacy scores (M=-.128, SD=.158) are more likely not to seek advice from any source, compared to those in the neutral group (M=-.056, SD=.110) and the unlikely group (M=-.337, SD=.061), F (2,271) =5.32, p=.005, partial η^2=.038. Thus, having a lower level of financial literacy is associated with a reluctance to seek advice from any formal or informal support network in our sample of older adults. Similarly, lower levels of cognitive function as measured on the SWMBE is associated with participant's being unlikely to seek advice, F (2,271) =4.34, p=.014, partial η^2=.031. Those likely to not seek any advice have higher mean errors on the SWMBE (M=17.32, SD=14.16) compared to those in the neutral group (M=15.44, SD=1.46) and those unlikely to not seek advice (M=12.96, SD=.62).

The results point to a robust relationship between level of cognitive function and the likelihood of seeking support from various sources. A lower level of cognitive function is associated with a reduced likelihood of seeking advice from a partner, children, and from formal sources such as a GP. Seeking support from distal, informal, and somewhat anonymous sources, such as online resource and searches, was favoured by those with poorer levels of cognition. Of interest was the finding that participants with lower levels of financial literacy and lower levels of cognition were unlikely to seek advice from any source. Our results therefore suggest that the most vulnerable older adults who would benefit the most from instrumental and informational support, are the ones least likely to seek advice and support.

6.5 Relationship status and cognitive function

Relationship status is a strong predictive factor when considering cognitive health and coping in older age. Studies have shown marriage and intimate partnerships foster wellbeing (James, Wilson, Barnes, & Bennett, 2011) and play an important role in social and instrumental support, and facilitate coping in time of social and economic stress (Conger & Conger, 2002). As such we were interested in examining whether being in a partnered relationship or having dependants in the household facilitated the maintenance of better cognitive health. The majority of participants in our study reported being in a partnered relationship (69.5%) and being in a household without dependants (90%). To investigate whether there were any differences in cognitive function depending on the type of relationship, a MANOVA was conducted (see Table 18, Appendix 6). As in the previous analysis, types of relationships were used as the grouping variables (i.e. single/partnered, with dependants/ without dependants) with the three cognitive measures (i.e. PAL, RVPA, SWMBE) as dependent variables. The results indicate there is no significant difference between type of relationship (single/partnered) $F(3,301) = 5.05$, $p = .679$; Wilk's Lambda = .99; partial eta squared = .005, or having dependants/no dependants $F(3,301) = 2.85$, $p = .038$; Wilk's Lambda = .97; partial eta squared = .028, on the combined dependent variables, using a Bonferroni adjusted alpha level of .017. Mean scores indicate that single participants with dependants have slightly fewer errors on the PAL task compared to those without dependants (see Table 9 for details). Similarly, better performance on the SWMBE is recorded for both single and partnered participants with dependants compared to those without dependants. However the mean difference is not statistically significant.

The results point to a trend for older adults with dependants in the household to have higher levels of cognitive function. More research will help to better understand the relationships between cognitive health and proximal intimate and family relationships.

Table 9: *Mean scores for cognitive assessments with relationship status and household demographics*

Relationship status	Household	PAL		RVPA		SWMBE	
		M	SD	M	SD	M	SD
Single	With dependants	2.8	3.11	.91	.07	7.00	9.67
	Without dependants	4.69	4.24	.89	.06	15.80	7.56
Partnered	With dependants	4.22	4.52	.92	.04	10.44	8.80
	Without dependants	4.68	4.84	.90	.05	13.88	8.70

6.6 Cognitive assessment preferences

As a major focus of this study, participants were asked to indicate their preference for alternative delivery methods of cognitive assessment. As previously reported in Table 3, the majority (54%) indicated a preference for computer or tablet-based assessments. However 10 percent preferred pencil and paper assessments, with 33 percent indicating no preference. To ascertain if different types of assessments were preferred by people with different levels of cognitive scores, a Multivariate Analysis of Variance (MANOVA) was conducted (see Table 19, Appendix 6).

Type of assessment preferred was used as the grouping variable with the three cognitive measures (i.e. PAL, RVP, SWMBE) as dependent variables. There is no significant difference between type of assessment preferred on the combined dependent variables F (9,728) =1.97, p = .04; Wilk's Lambda = .94; partial eta squared = .02. Mean scores indicate that those recording a higher number of errors on the PAL and poorer performance on the SWMBE task prefer pencil and paper assessments (see Table 10 below), but this is not statistically significant.

Table 10: *Mean scores for cognitive assessments with type of assessment preferred*

Type of Assessment		PAL		RVPA		SWMBE	
	N	M	SD	M	SD	M	SD
None, I wouldn't like to do any assessment	16	3.14	5.12	.88	.06	13.14	4.14
Pencil and paper type assessment	54	6.04	5.07	.89	.05	17.35	8.13
Computer/tablet/iPad-based assessment	297	4.95	4.64	.91	.05	13.39	8.50
No preference	180	3.84	4.36	.90	.52	14.29	8.83

The CANTAB online assessment was generally well-received, with respondents keen to complete Stage 2 and contribute to the research. Many participants persevered with the assessments despite having technical setbacks. Examples of feedback to the study Helpline included:

> *After four attempts: 'I just used the right browser and completed the task! Regards'.*
>
> *'Hi. My laptop battery ran out midway through so had to restart. Anyway, seemed to work ok 2nd time'.*
>
> *'I recently tried to complete step 2 of your online survey. I can't remember what happened but for some reason I couldn't complete it. I would like to continue with the survey. Would you please let me know how I can do this?'*

Feedback was also received commenting on the utility and usefulness of the assessments, even though some found the tasks difficult. For example:

> *'I really enjoy these health-related surveys- to the benefit of everyone'.*
>
> *'I just did Stage Two and found the last task almost impossible with more than one set of numbers. A couple of the other tasks were also difficult once I got past about four things to remember! Thank you for all the work you are doing'.*
>
> *'Hi. I did complete Stage 2, going thru all the gruelling visual quizzes'.*
>
> *'My father and grandmother both died of dementia so I have a personal interest in the topic, when I remember! Don't worry about the gift card as I would only spend it on red wine and that simply worsens the situation!'.*

Delivery of the assessments was complicated due the CANTAB only being currently compatible with a select set of browsers and devices. If participants did not have compatible systems and devices they were unable to access and complete Stage 2 of the study. This was frustrating for many participants and resulted in a lower than anticipated conversion rate from Stage 1 to Stage 2 of the study. One participant commented:

> *'Hi. The two biggest browsers are IE and Firefox. Why set up a system with browsers that are not popular? How will I download these other browsers and not ruin my other computer works? Any advice?'.*

When the CANTAB assessments are further developed in the near future to be compatible with a wider scope of browsers, delivery of the assessments to older adults in the field will be simplified, improving the likely uptake of online assessment as a viable delivery methodology for cognitive screening.

7. IMPLICATIONS FOR FUTURE RESEARCH

There are a number of implications for the design of future research studies.

In general, the sample selected was well-educated, financially literate, and wealthier than the general population. There is an opportunity to expand data collection to reflect those with lower incomes and levels of education but it would most likely require improving access to computer tablets. This might be possible by making tablets available to community groups or providing a visiting mobile resource to complete the assessments. These mobile cognitive health units might operate similar to breast screening mobile units.

The CANTAB technology offers an ideal opportunity for people to be assessed at home (as preferred) but this has two major impediments. Firstly, undertaking the tablet-based assessments will not deliver results – just enable test administration. We are not advocating self-assessment, just self-administration. There may be issues around people's ability to cope with an assessment of decline, and feedback should be delivered by a health-based practitioner. How to efficiently deliver feedback is yet to be fully explored. It may be possible to involve community nurses, optometrists, and/or pharmacists. Secondly, the failure rates on completion of the three cognitive assessments warrant further investigation. Some of these were user error, some browser incompatibility and infrastructure (i.e. continuous wi-fi supply). These issues need to be resolved to enable more general use, and we are working with the CANTAB software developers to assist these efforts.

Significant differences in the financial literacy measures were observed between males and females, with females underperforming and less confident. Future studies should include measures of mastery to confirm whether the issues are ability-based or psychological. This is an important differentiator because it informs the types of interventions necessary. If psychological in nature, then mastery interventions may help, but if they are ability-related, then financial literacy education might better assist. These interventions are especially important given the high number of participants reporting shared financial decision-making with partners who may experience the loss of a spouse, as well as for single women without partners.

One of the motivations to using CANTAB was to overcome the effects of education on other cognitive measures (e.g. mini-mental status examination). CANTAB appears more robust to education effects, though differences were evident between the highest education category (postgraduate) and the lowest (highest education is Year 10). What remains to be seen is whether these effects mask actual decline over time. Here the better comparison will be within individuals over time rather than between individuals, further justifying the use of longitudinal research designs.

Longitudinal designs would also assist in helping to understand the relationship between financial literacy and CANTAB measures. Do declines in cognition accompany, precede, or follow financial literacy declines? Only data collected over time with the same participants can answer this type of research question. It is an important research question because it may be that if declines are detected in either measure we may be able to anticipate decline in the other, or one assessment could serve as a proxy for others, thus reducing the need for more extensive assessments.

8. IMPLICATIONS FOR INTERVENTIONS AND SERVICE DELIVERY

It would appear that although participants were concerned about their ability to cope with decline, they are more concerned about the impact on those around them. In turn this appears as a reluctance to involve significant others when there is cause for genuine concern. There is some evidence to suggest that those with lower scores prefer online advice but the effectiveness of this as a strategy is dependent on the source of online information or support. Better ways are needed to engage those people who would most benefit from on-going monitoring.

Less than 3 percent of the sample showed no interest in monitoring decline. Online assessments appear to be the most highly-favoured for on-going monitoring. More than half of the sample nominated online assessments as the preferred delivery, and another third expressed no preference for format of delivery. As outlined earlier, online administration is advocated but not online feedback, which should be practitioner-assisted. Future investigations should focus on ways of administering assessments online and delivering confidential results. There may be opportunities to involve other trusted health professionals such as pharmacists or optometrists as well as GPs. About one third of the sample were prepared to pay between $10 – $50 to undertake such an assessment, and another third would access a service if it was covered by Medicare.

Pursuing online administration of cognitive measures is worthwhile because, it would appear, people are not good judges of their own cognition. The subjective ratings provided by the HABC are providing different measures than the tablet-based technology offered by CANTAB. These assessments offer the opportunity for individuals to calibrate their own perceptions with an objective measure of their cognitive status. However, as outlined earlier some of the issues regarding access and reliable administration would need to be addressed to ensure longer-term viability.

Participants indicated concern about cognitive decline interfering with work or volunteering, but if a suspected decline results in withdrawal from activities, this may be premature if untested, or when a temporary decline is assumed to be permanent. Making assessments more easily available will minimise this possibility. More education is needed about day-to-day functioning during decline and understanding that independence is possible until decline is well-advanced. Stories of people living with dementia provide valuable role models for this purpose.

Partners play an important role in providing support in the face of decline and making financial decisions. People who are particularly vulnerable are those with lower cognitive scores who are less inclined to involve others. There is also vulnerability when the partner is lost, especially if the partner was the more financially literate and more likely to take the decision-making lead. Especially at risk are older single women with lower levels of education and financial literacy who lack confidence and are without any family support. This highlights the importance of services such as the National Seniors Australia, Financial Information Desk and the AFA pro-bono advice network.

Lastly, those older Australians designing strategies to empty the nest should take solace in the fact that there may be some cognitive benefits to keeping children at home for longer. In our study at least, those people with the best scores on the online cognitive assessments were more likely to have dependants still living with them. More research is needed to determine the underlying explanation for these differences.

9. SUMMARY

This report provides an overview of cognitive and financial factors that contribute to optimal functioning among older adults. It also provides a platform for investigating promising initiatives in the context of uptake of new technologies in the delivery and acceptance of regular cognitive screening in older populations. The key findings identified inter-relationships between cognitive function and financial literacy and wellbeing in older adults. Cognitive health, age, and level of education were identified as important factors in helping people cope with financial decision-making and in maintaining financial sufficiency as they age. It was also the case that older adults with lower levels of cognitive health were less likely to access social support networks or seek instrumental or informational advice in the event of cognitive decline. Regular cognitive screening in the community is therefore considered to be warranted given the results from this study and the generally positive response to the CANTAB online assessments. Although our study was somewhat limited in that the sample was relatively high functioning, it could be surmised that individuals from lower socio-economic groups with less education and advantage, and in older age brackets, may be even more susceptible to the negative consequences of cognitive decline and lower levels of financial literacy. However, this question awaits further research with a more representative sample to fully integrate the present findings, and identify cognitive, social, and financial factors that promote positive functioning during later life.

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APPENDIX 1: SELECTED ITEMS FROM STAGE 1 QUESTIONNAIRE

1. Financial Wellbeing (Consumer Financial Protection Bureau, 2015)

1.1 How well do the following statements describe you or your situation?

Completely	Very well	Somewhat	Somewhat	Very little	Not at all
(1)	(2)	(3)	(4)	(5)	(6)

a. Because of my money situation, I feel like I will never have the things I want in life (1)

b. I am just getting by financially (2)

c. I am concerned that the money I have or will save won't last (3)

1.2 How often do the following statements apply to you?

Always	Often	Sometimes	Rarely	Never
(1)	(2)	(3)	(4)	(5)

a. I have money left over at the end of the month

b. My finances control my life

2. Financial Risk Tolerance (Jacobs-Lawson & Hershey, 2005)

2.1 Using a scale of 1 to 7, where 1 is "Completely Disagree" and 7 is "Completely Agree" please indicate whether you agree or disagree that each of the following statements describe you:

a. I am willing to risk financial losses

b. I prefer investments that have higher returns even though they are riskier

c. As a rule, I would never choose the safest investment when investing

d. The overall growth potential of an investment is more important than the risk of the investment

e. I am very willing to make risky investments to ensure financial security in the future

3. 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.

3.1 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)

3.2 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)

3.3 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)

3.4 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 (1)	True (1)	False (2)	Don't know (3)
b. A share managed fund combines the money of many investors to buy a variety of shares (2)	True (1)	False (2)	Don't know (3)
c. After age 65, you have to withdraw at least some money from your superannuation fund. (3)	True (1)	False (2)	Don't know (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 (4)	True (1)	False (2)	Don't know (3)
e. Fixed interest securities (bonds) are normally riskier than shares (5)	True (1)	False (2)	Don't know (3)

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)

3.6 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)

3.7 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)

3.8 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)

3.9 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)

4. Applied Financial Literacy – Super (New Measure. Question 3 taken from Amar et al., 2011)

4.1Here are a few more questions about money, superannuation, and the government age pension. Please indicate what you think is the correct answer.

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)

4.2 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)

4.4 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)

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

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

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

Appendix 2: Overview of Measures used in Stage 1

Socio-demographic variables

Single items were used to assess participant age, gender, ethnicity, highest education level, relationship status, number of dependents, home ownership, employment status, state and postcode.

Financial demographic measures

Financial demographics were assessed with six questions targeting household annual income, individual annual income, discretionary monthly income, net value of the family home, net value of investment assets, and current superannuation status.

Financial literacy measures

Financial literacy was measured using a 13-item scale previously validated by Fernandes, Lynch, & Netemeyer, 2014 (see Appendix 1). The scale includes both 'basic' concepts (numeracy, inflation, time value of money, money illusion, and compound interest), and advanced concepts (risky assets, long period returns, volatility, and diversification. In addition, participants were also asked to indicate how many of the questions they considered they correctly answered which enable a measure of confidence to be constructed. Answers were scored as either correct (1) or incorrect (0). The total score was the sum of the 13-items, range 0 to 13 with higher scores representing higher levels of financial literacy.

Applied financial literacy was assessed using a scale of four questions developed from Earl and Gerrans (Earl, Gerrans, Asher, & Woodside, 2015). The scale (see Appendix 1) delivers an applied measure of financial literacy and examines management of financial assets (credit cards), superannuation, and the age pension. For example, whether there is any guarantee on investments in superannuation, and a question related to the pension means test. Again, participants were asked to report their confidence in the number of correctly answered questions. Questions were scored as either correct (1) or incorrect (0), giving a range of 0 to 4. Higher scores indicate better applied financial literacy.

Financial wellbeing was assessed using the 5-item abbreviated scale developed by the U.S. Center for Financial Protection Bureau (CFPB, 2015). Participants were asked to consider how applicable they found a series of statements. For example, 'Because of my money situation, I feel like I will never have the things I want in life' (refer Appendix 1). Statements were answered on a 5-point scale anchored from completely (1) to never (5), or always (1) to never (5). After adjustment for reversed coding, the five items were summed to provide a total score, with higher scores indicating better financial wellbeing. The scale produces a standardised number between 0 and 100 representing 'the respondent's underlying level of financial well-being' (CFPB, 2015). The expectation is that 'most people's scores will fall somewhere in the middle – extremely low or extremely high scores will be uncommon' (CFPB, 2015).

Financial risk tolerance was measured using the five-item scale developed by Jacobs-Lawson, Joy, and Hershey (2005). Items included statements such as 'The overall growth potential of an investment is more important than the risk of the investment', and 'I am willing to risk financial losses' (see Appendix 1). Items were answered on a 7-point scale anchored from completely disagree (1) to completely agree (7). Items were summed to provide a total score ranging from 0 to 5, higher scores indicating a higher level of risk tolerance.

Subjective ability and knowledge assessments were measured using five items. Participants rated: i) their ability to make day-to-day financial decisions (such as budgeting, what is the best phone contract, loan etc.); ii) their knowledge of investing in financial assets (such as shares, bonds etc.); iii) their knowledge of superannuation and retirement income products; and iv) their ability to make changes to superannuation and/or retirement income products. Items were answered on a 7-point scale anchored from extremely poor (1) to extremely good (7), with items summed to produce scores ranging from 0 to 24, higher scores indicative of a higher level of subjective financial ability. A final measure sought ability to do general maths.

Subjective Cognitive Function

HABC Monitor:

Subjective cognitive function was measured using the Healthy Aging Brain Centre Monitor (HABC: see Appendix 1). This instrument was developed as a multi-dimensional tool to measure cognitive, functional, and behavioural/psychological symptoms and an indication of quality of life (Monahan et al., 2008). The 30-item self-report version was included in this study assessing the four domains. Participants were asked to indicate how often during the past two weeks they experienced problems in each domain. For example, with 'Judgement or decision-making', 'Remembering appointments' (cognitive domain), 'Walking or physical ambulation' (functional domain), 'Feeling down, depressed or hopeless' (behavioural/psychological domain), or 'Your financial future' (quality of life). Questions were answered on a 4-point scale anchored from not at all [0-1 day] (0) to almost daily [12-14 days] (3). Scores were computed summing all items in each individual scale (i.e. the sum of items 1 to 8 for the cognition score, items 9 to 16 for functional score, items 17 to 26 for the behavioural/psychological score, and items 27 to 30 for quality of life). Higher scores represent more symptoms or worse performance in the domain. The HABC Monitor has been shown to have good reliability and validity for monitoring clinical symptoms of mild cognitive decline (Monahan, Alder, Khan, & Stump, 2014).

Cognitive assessment advice and concerns about cognitive decline:

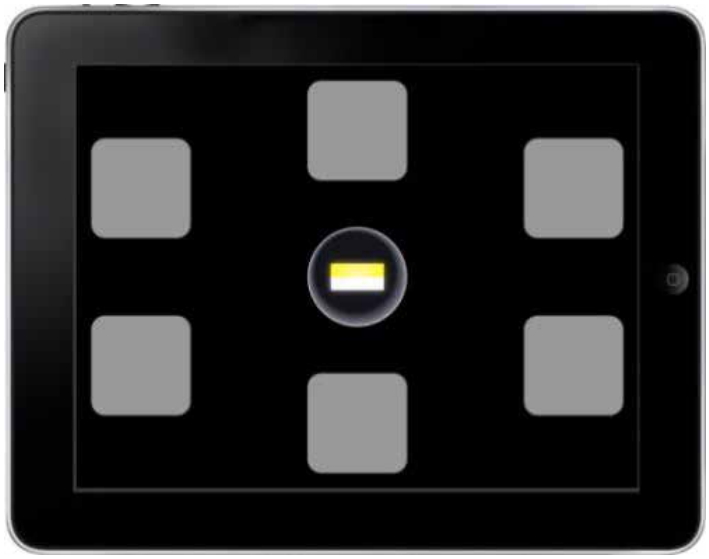
Sources of support in the event of declining cognitive function were assessed with participants indicating how likely they were to seek help from a list of nominated sources. Responses on a 5-point scale were anchored from extremely unlikely (1) to extremely likely (5), as well as a not applicable option. Two additional items assessed decision-making and support, asking participants: i) who they had available to consult with for assistance or information when making important decisions; and ii) who made important decisions in the past in nominated domains. The person responsible for decision-making was indicated on a 6-point scale anchored from not applicable - never made the decision (1) to somebody else made the decision for me (6). The extent and nature of participant concerns in dealing with declining cognitive function was assessed using 16-items such as I would be concerned that 'My friends would trust me less', or that I couldn't 'Be independent'. Responses were made on a 5-point scale anchored from strongly agree (1) to strongly disagree (5).

APPENDIX 3: 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).

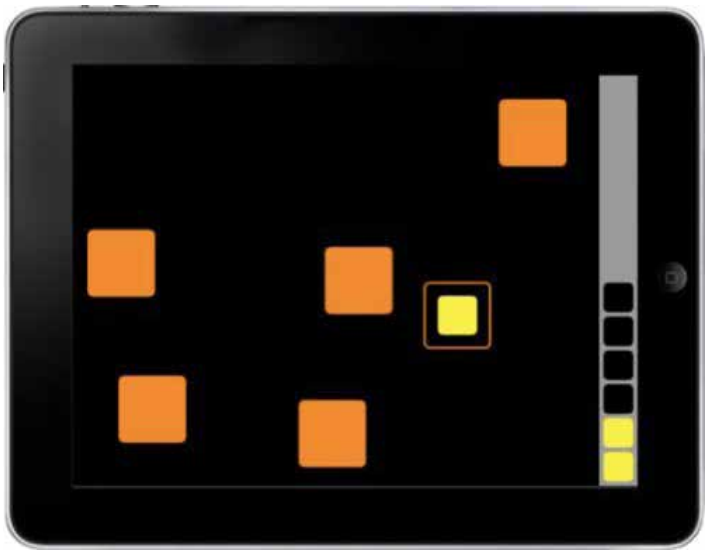
Paired Associates Learning (PAL):
Paired Associates Learning (PAL) targets visual episodic memory and new learning, taking approximately 8 minutes to complete online. In this test, boxes are displayed on-screen and opened in a pseudo-randomised order. One or more boxes contain a pattern which is then displayed in the middle of the screen one at a time. The participant must select the box in which the pattern was originally located. Outcome measures include number of errors, number of trials required, and memory scores. The total number of errors for the six-box sequence adjusted for incomplete or failed trials (PALTEA6) was used as the outcome measure for this test (Cambridge Cognition Ltd, 2017), with higher scores indicating more errors and poorer performance. The CANTAB PAL test has been found to discriminate between those with normal cognitive function and clinical populations, including mild cognitive impairment (Saunders & Summers, 2010), and has been validated as measuring episodic memory (Lenehan, Summers, Saunders, Summers, & Vickers, 2016).

Figure 12: *Screen display of CANTAB Paired Associates Learning task*



Spatial Working Memory (SWMBE):
This test assesses visuospatial working memory and executive function and is performed over approximately 5 minutes. The SWMBE challenges participants to retain and manipulate visuospatial information, demanding executive function recruitment while also providing measures of strategy and working memory errors. In this test a number of boxes appear on-screen which the participant must search to find a yellow token used to fill an empty column on the right side of the screen. The number of boxes increases from 3 to 8. Outcome measures include number of errors, and measures of strategy and latency. The outcome measure for this study was the SWM between errors (SWMBE), which reports the number of times a box is re-opened in which a token has previously been found, indicating failure to recall (Cambridge Cognition Ltd, 2017) (Lenehan, Summers, Saunders, Summers, & Vickers, 2016) (Smith, Need, Cirulli, Chiba-Falek, & Attix, 2013). Higher scores represent poorer performance.

Figure 13: *Screen display of CANTAB Spatial Working Memory task*



Rapid Visual Information Processing (RVPA):

The RVPA test measures sustained attention and processing speed and takes approximately 9 minutes to complete. A white box appears on-screen displaying a digit between 1 and 9 in a random order at the rate of 100 digits/minute. The participant must detect sequences of digits (2-4-6, 3-5-7) and respond as quickly as possible. Difficulty varies with either one to three sequences, with two sequences delivered in this study.

The RVPA is a ratio score of the probability of a correct 'hit' to the probability of a 'miss' reflecting the accuracy of target signal detection by the participant (Cambridge Cognition Ltd, 2017) (Klekociuk, Summers, Vickers, & Summers, 2014) (Lenehan, Summers, Saunders, Summers, & Vickers, 2016).

Figure 14: *Screen display of CANTAB Rapid Visual Processing task*

APPENDIX 4: RESULTS OF SUBJECTIVE AND OBJECTIVE COGNITION MEASURES.

Table 11: *Mean scores for the four domains of the HABC monitor*

HABC Domain	Min	Max	M (SD)
HABC cognitive domain (Range 0-24)	0	12	1.16 (1.66)
HABC functional domain (Range 0 -24)	0	19	1.06 (2.51)
HABC behavioural & psychological domain (Range 0-30)	0	22	2.26 (3.20)
HABC quality of life score (Range 0 -12)	0	11	1.41 (2.01)
HABC total score (Range 0-90)	0	56	5.88 (7.85)

Table 12: *Results of correlation analyses of HABC, Education, PAL, RVP, and SWMBE*

	HABC Cog	HABC Func	HABC Beh/Psyc	HABC QoL	PALTEA 6	RVPA	SWMBE
HABC Cog[1]	1						
HABC Func[2]	.48**	1					
HABC Beh/Psyc[3]	.60**	..56**	1				
HABC QoL[4]	.55**	.57**	.72**	1			
PALTEA6[5]	.02	.-.01	.03	.04	1		
RVPA[6]	-.04	-.14*	-.02	-.03	-.22**	1	
SWMBE[7]	-.00	.01	-.03	-.01	.23**	-.32**	1

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/ psychological domain, [4] is Healthy Aging Brain Centre monitor quality of life domain, [5] is Paired Associated Learning score, [6] is Rapid Visual Processing score, [7] is Spatial Working Memory score.
*** = p <.001,** = p <.01, * = p <.05

APPENDIX 5. RESULTS OF HIERARCHICAL MULTIPLE REGRESSION ANALYSES

Table 13: *Results of HMR Analyses of PAL with Gender, Age, Education and HABC domains*

Paired Associates Learning (PALTEA6 score)					
Predictor		B	SE	β	ρ
Step 1	Constant	-7.160	2.797		.011
	Male	.917	.630	.079	.147
	Age	.182	.042	.214	.000
	R^2 = .057, F(2,326) = 11.63, ρ =.000				
Step 2	Constant	-6.290	2.898		.031
	Male	.983	.650	.085	.132
	Age	.159	.045	.188	.000
	Highest Ed. (Post. Grad base)				
	Bachelor	.539	.881	.036	.051
	Diploma, Advanced Diploma	.423	.786	.034	.591
	Secondary	1.831	1.334	.090	.072
	Year 10	1.894	1.118	.112	.091
	R^2_{change} = .014, F(4,322) = 1.71, ρ =.324				
Step 3	Constant	-7.096	2.938		.016
	Male	.918	.658	.079	.164
	Age	.168	.042	.198	.000
	Highest Ed. (Post. Grad base)				
	Bachelor	.562	.893	.037	.529
	Diploma, Advanced Diploma	.449	.798	.036	.574
	Secondary	1.619	1.339	.079	.007
	Year 10	1.814	1.134	.107	.111
	HABC Cognitive	.045	.245	.014	.853
	HABC Functional	-.177	.161	.068	.273
	HABC Beh and Psyc	.085	.157	.046	.588
	HABC Quality of Life	.116	.223	.041	.601
	R^2_{change} = .005, F_{change}(4,318) = .395, ρ =.813				

Table 14: *Results of HMR Analyses of RVP with Male, Age, Education and HABC domains*

Rapid Visual Processing (RVP)					
Predictor		B	SE	β	ρ
Step 1	Constant	1.030	.030		.000
	Male	-.000	.006	-.001	.982
	Age	-.002	.002	-.248	.000
	R^2 = .062, F(2,306) = 8.78, ρ =.000				
Step 2	Constant	1.015	.030		.000
	Male	-.001	.006	-.009	.878
	Age	-.002	.000	-.207	.001
	Highest Ed. (Post. Grad base)				
	Bachelor	.006	.008	.042	.475
	Diploma, Advanced Diploma	-.011	.008	-.099	.152
	Secondary	-.016	.011	-.088	.132
	Year 10	-.016	.010	-.108	.091
	R^2_{change} = .023, F(4,302) = 1.935, ρ =.105				
Step 3	Constant	1.001	.031		.000
	Male	-.003	.006	-.026	.646
	Age	-.002	.000	-.190	.003
	Highest Ed. (Post. Grad base)				
	Bachelor	.006	.008	.047	.430
	Diploma, Advanced Diploma	-.009	.008	-.079	.260
	Secondary	-.019	.011	-.103	.084
	Year 10	-.018	.010	-.117	.071
	HABC Cognitive	-.000	.002	-.007	.921
	HABC Functional	-.005	002	-.188	.007
	HABC Beh and Psyc	.001	.001	.071	.412
	HABC Quality of Life	.001	.002	.033	.711
	R^2_{change} = .021, F_{change}(4,298) = 1.77, ρ =.135				

Table 15: *Results of HMR Analyses of SWMBE with Gender, Age, Education and HABC domains*

Spatial Working Memory (SWMBE)					
Predictor		B	SE	β	ρ
Step 1	Constant	-13.753	4.568		.206
	Male	-1.154	.911	-.067	.206
	Age	.416	4.568	.329	.003
	R^2 = .106, F(2,324) = 19.69, ρ =.000				
Step 2	Constant	-11.885	4.586		.010
	Male	-.913	.912	-.053	.318
	Age	.363	.069	.288	.000
	Highest Ed. (Post. Grad base)				
	Bachelor	1.003	1.361	.044	.461
	Diploma, Advanced Diploma	2.389	1.166	.128	.041
	Secondary	1.078	1.877	.066	.269
	Year 10	3.961	1.464	.157	.007
	R^2_{change} = .023, F(4,320) = 2.068, ρ =.085				
Step 3	Constant	-13.259	4.691		.005
	Male	-1.048	.918	-.061	.254
	Age	.382	.069	.303	.000
	Highest Ed. (Post. Grad base)				
	Bachelor	1.112	1.368	.049	.417
	Diploma, Advanced Diploma	2.473	1.184	.132	.038
	Secondary	1.958	1.907	.062	.305
	Year 10	3.670	1.470	.147	.012
	HABC Cognitive	-.119	.369	-.025	.748
	HABC Functional	-.184	.230	-.047	.424
	HABC Beh and Psyc	.408	.223	.145	.069
	HABC Quality of Life	-.303	.287	-.070	.293
	R^2_{change} = .008, F_{change}(4,316) = .743, ρ =.563				

Table 16: *HMR Analyses of Financial Literacy, Financial Risk Tolerance, Financial Wellbeing*

This table presents hierarchical regressions estimations for the measures of financial literacy, risk tolerance, and financial wellbeing. In the first step gender, age, & education are entered, with the CANTAB test score entered in Step 2. Each panel presents a different test score (PAL, RVPA, SWMBE). Step 2 estimations are reported with tests for Step 2 vs Step 1 reported.

PANEL A - PAL		B	SE	β	ρ
Financial Literacy (FLN)					
Step 2	Constant	13.457	1.265		0.000
	Male	1.868	0.264	0.371	0.000
	Age	-0.052	0.020	-0.142	0.008
	Highest Ed. (Post. Grad base)				
	Bachelor	-0.376	0.330	-0.057	0.255
	Diploma, Advanced Diploma	-1.272	0.326	-0.232	0.000
	Secondary	-1.903	0.557	-0.215	0.001
	Year 10	-0.992	0.428	-0.134	0.021
	PAL	-0.024	0.023	-0.056	0.289
	R^2 Step 2 0.220 R^2_{change} =0.003, $F_{change}(1,321)$ = - 1.199, ρ =0.274				
Financial Literacy Applied					
Step 2	Constant	2.669	0.670		0.000
	Male	0.339	0.121	0.156	0.005
	Age	0.001	0.010	0.005	0.938
	Highest Ed. (Post. Grad base)				
	Bachelor	0.064	0.176	0.023	0.717
	Diploma, Advanced Diploma	-0.103	0.166	-0.044	0.534
	Secondary	-0.308	0.229	-0.081	0.180
	Year 10	-0.020	0.214	-0.006	0.926
	PAL	-0.022	0.012	-0.118	0.054
	R^2 Step 2 0.042 R^2_{change} = 0.013, $F_{change}(1,321)$ = 4.319, ρ =0.038				
Financial Risk Tolerance					
Step 2	Constant	3.191	0.674		0.000
	Male	0.597	0.135	0.242	0.000
	Age	-0.005	0.010	-0.027	0.639
	Highest Ed. (Post. Grad base)				
	Bachelor	0.100	0.212	0.031	0.639
	Diploma, Advanced Diploma	-0.599	0.173	-0.223	0.001
	Secondary	-0.731	0.248	-0.168	0.003
	Year 10	-0.579	0.208	-0.160	0.006
	PAL	0.012	0.012	0.055	0.323
	R^2 Step 2 0.132 R^2_{change} = 0.003, $F_{change}(1,321)$ = 1.042, ρ =0.308				
Financial Wellbeing					
Step 2	Constant	47.717	6.990		0.000
	Male	-0.081	1.525	-0.003	0.958
	Age	0.273	0.106	0.137	0.010
	Highest Ed. (Post. Grad base)				
	Bachelor	-0.090	2.100	-0.003	0.966
	Diploma, Advanced Diploma	-5.397	1.896	-0.183	0.005
	Secondary	-10.579	2.957	-0.222	0.000
	Year 10	-10.684	2.372	-0.269	0.000
	PAL	0.020	0.130	0.008	0.879
	R^2 Step 2 0.094 R^2_{change} = .000, $F_{change}(1,321)$ =-0.023, ρ =0.878				

Table 16. *cont.*

PANEL B - RVPA		B	SE	β	ρ
Financial Literacy (FLN)					
Step 2	Constant	2.574	2.939		0.382
	Male	1.818	0.268	0.365	0.000
	Age	-0.038	0.020	-0.105	0.065
	Highest Ed. (Post. Grad base)				
	Bachelor	-0.528	0.357	-0.081	0.141
	Diploma, Advanced Diploma	-1.131	0.321	-0.207	0.000
	Secondary	-1.489	0.563	-0.166	0.009
	Year 10	-0.839	0.405	-0.116	0.039
	RVPA	10.810	2.478	0.224	0.000
	R^2 Step 2 0.251 R^2_{change} =0.046, $F_{change}(1,301)$ = 18.454, ρ =0.000				
Financial Literacy Applied					
Step 2	Constant	1.593	1.406		0.258
	Male	0.335	0.123	0.158	0.007
	Age	-0.002	0.011	-0.013	0.853
	Highest Ed. (Post. Grad base)				
	Bachelor	0.036	0.177	0.013	0.840
	Diploma, Advanced Diploma	-0.126	0.171	-0.054	0.463
	Secondary	-0.221	0.217	-0.058	0.310
	Year 10	-0.011	0.210	-0.004	0.959
	RVPA	1.298	1.152	0.063	0.261
	R^2 Step 2 0.033 R^2_{change} = 0.003, $F_{change}(1,301)$ = 1.116, ρ =0.292				
Financial Risk Tolerance					
Step 2	Constant	3.750	1.619		0.021
	Male	0.578	0.138	0.233	0.000
	Age	-0.003	0.011	-0.018	0.762
	Highest Ed. (Post. Grad base)				
	Bachelor	0.124	0.220	0.038	0.574
	Diploma, Advanced Diploma	-0.592	0.181	-0.218	0.001
	Secondary	-0.764	0.263	-0.171	0.004
	Year 10	-0.687	0.209	-0.190	0.001
	RVPA	-0.660	1.483	-0.027	0.657
	R^2 Step 2 0.134 R^2_{change} = 0.001, $F_{change}(1,301)$ = 1.042, ρ =0.626				
Financial Wellbeing					
Step 2	Constant	20.579	16.016		0.200
	Male	-0.223	1.583	-0.008	0.888
	Age	0.331	0.109	0.166	0.003
	Highest Ed. (Post. Grad base)				
	Bachelor	0.012	2.181	0.000	0.996
	Diploma, Advanced Diploma	-4.598	1.976	-0.154	0.021
	Secondary	-8.285	2.990	-0.169	0.006
	Year 10	-10.240	2.436	-0.257	0.000
	RVPA	25.654	14.902	0.097	0.086
	R^2 Step 2 0.094 R^2_{change} = .000, $F_{change}(1,301)$ =-0.023, ρ =0.878				

Table 16. *cont.*

PANEL C - SWMBE		B	SE	β	ρ
Financial Literacy (FLN)					
Step 2	Constant	13.049	1.282		0.000
	Male	1.819	0.258	0.366	0.000
	Age	-0.037	0.020	-0.103	0.067
	Highest Ed. (Post. Grad base)				
	Bachelor	-0.383	0.331	-0.059	0.248
	Diploma, Advanced Diploma	-1.130	0.313	-0.210	0.000
	Secondary	-1.639	0.556	-0.182	0.003
	Year 10	-0.719	0.406	-0.099	0.078
	SWMBE	-0.058	0.013	-0.199	0.000
	R^2 Step 2 0.254 R^2_{change} =0.035, $F_{change}(1,319)$ = 14.822, ρ =0.000				
Financial Literacy Applied					
Step 2	Constant	2.732	0.668		0.000
	Male	0.330	0.119	0.156	0.006
	Age	0.001	0.010	0.006	0.930
	Highest Ed. (Post. Grad base)				
	Bachelor	0.042	0.175	0.015	0.813
	Diploma, Advanced Diploma	-0.064	0.166	-0.028	0.698
	Secondary	-0.164	0.219	-0.043	0.454
	Year 10	0.065	0.208	0.021	0.756
	SWMBE	-0.015	0.007	-0.118	0.040
	R^2 Step 2 0.041 R^2_{change} = 0.012, $F_{change}(1,319)$ = 3.984, ρ =0.047				
Financial Risk Tolerance					
Step 2	Constant	2.952	0.682		0.000
	Male	0.595	0.133	0.239	0.000
	Age	0.001	0.011	0.004	0.940
	Highest Ed. (Post. Grad base)				
	Bachelor	0.119	0.214	0.036	0.579
	Diploma, Advanced Diploma	-0.569	0.174	-0.211	0.001
	Secondary	-0.721	0.256	-0.160	0.005
	Year 10	-0.617	0.209	-0.170	0.003
	SWMBE	-0.007	0.008	-0.048	0.404
	R^2 Step 2 0.134 R^2_{change} = 0.002, $F_{change}(1,319)$ = 0.747, ρ =0.388				
Financial Wellbeing					
Step 2	Constant	46.254	7.120		0.000
	Male	0.180	1.520	0.007	0.906
	Age	0.311	0.110	0.157	0.005
	Highest Ed. (Post. Grad base)				
	Bachelor	0.111	2.117	0.003	0.958
	Diploma, Advanced Diploma	-4.976	1.896	-0.170	0.009
	Secondary	-9.061	2.928	-0.185	0.002
	Year 10	-9.905	2.344	-0.251	0.000
	SWMBE	-0.093	0.083	-0.060	0.263
	R^2 Step 2 0.094 R^2_{change} = .000, $F_{change}(1,319)$ =-0.023, ρ =0.878				

APPENDIX 6: RESULTS OF MANOVA ANALYSES

Table 17: *MANOVA results for sources of advice, financial literacy and cognition*

IV	DV	F	d/f	Sig	Partial η^2
Advice Partner	Financial literacy	2.207	2/209	.113	.021
	Applied financial literacy	2.378	2/209	.095	.022
	HABC cognitive	2.731	2/209	.067	.025
	PAL	5.595	2/209	.004	.051
	RVPA	2.343	2/209	.099	.022
	SWMBE	1.228	2/209	.295	.012
	F(12,408)=2.087, ρ = .017, Wilk's lambda = .888				
Advice Children	Financial literacy	.214	2/254	.808	.002
	Applied financial literacy	2.371	2/254	.095	.018
	HABC cognitive	2.609	2/254	.076	.020
	PAL	.962	2/254	.384	.008
	RVPA	3.853	2/254	.022	.029
	SWMBE	1.261	2/254	.285	.010
	F(12,498)=1.912, ρ = .044, Wilk's lambda = .914				
Advice Other Family	Financial literacy	1.499	2/214	.226	.014
	Applied financial literacy	2.653	2/214	.073	.024
	HABC cognitive	.088	2/214	.916	.001
	PAL	1.045	2/214	.354	.010
	RVPA	3.406	2/214	.035	.031
	SWMBE	1.887	2/214	.154	.017
	F(12,418)=1.553, ρ = .103, Wilk's lambda = .916				
Advice Friends	Financial literacy	.303	2/291	.739	.002
	Applied financial literacy	.343	2/291	.710	.002
	HABC cognitive	.620	2/291	.539	.004
	PAL	1.008	2/291	.366	.007
	RVPA	.153	2/291	.858	.001
	SWMBE	.376	2/291	.687	.003
	F(12.572)=.517, ρ = .905, Wilk's lambda = .979				
Advice Doctor/GP	Financial literacy	.295	2/294	.745	.002
	Applied financial literacy	.562	2/294	.571	.004
	HABC cognitive	1.124	2/294	.326	.008
	PAL	6.771	2/294	.001	.044
	RVPA	2.023	2/294	.134	.014
	SWMBE	.807	2/294	.447	.005
	F(12.578)=1.794, p = .046, Wilk's lambda = .929				

Table 17 *cont.*

IV	DV	F	d/f	Sig.	Partial η^2
Advice Online	Financial literacy	6.671	2/295	.001	.043
	Applied financial literacy	1.034	2/295	.357	.007
	HABC cognitive	3.668	2/295	.027	.024
	PAL	1.025	2/295	.360	.007
	RVPA	1.497	2/295	.226	.010
	SWMBE	2.642	2/295	.073	.018
	F(12.580)=2.392 ρ = .005, Wilk's lambda = .908				
No Advice	Financial literacy	3.739	2/271	.005	.038
	Applied financial literacy	.728	2/271	.478	.005
	HABC cognitive	2.298	2/271	.436	.006
	PAL	57.711	2/271	.156	.014
	RVPA	.005	2/271	.190	.012
	SWMBE	313.777	2/271	.014	.031
	F(12.532)=1.876 ρ = .035, Wilk's lambda = .920				

Table 18: *MANOVA results for relationship status and cognition*

IV	DV	F	d/f	Sig	Partial η^2
Single or partnered	PAL	7.904	1,303	.545	.001
	RVPA	.002	1,303	.445	.002
	SWMBE	9.199	1,303	.719	.000
	F(3,301)=.505, ρ = .6 79, Wilk's lambda = .995				
With dependents/ without dependents	PAL	1.008	1,303	.316	.003
	RVPA	1.439	1,303	.231	.005
	SWMBE	8.301	1,303	.004	.027
	F(3,301)=2.853, p = .038, Wilk's lambda = .972				

Table 19: *MANOVA results for preferred type of assessment and cognition*

IV	DV	F	d/f	Sig	Partial η^2
Assessment type	PAL	2.282	3,303	.079	.022
	RVPA	1.984	3,303	.116	.019
	SWMBE	1.545	3,303	.203	.015
	F(9,732)=1.968, ρ = .040, Wilk's lambda = .019				

Current publications:

McCallum, J & Rees, K (2017) *Consumer Directed Care in Australia: Early stage analysis and future directions*. Brisbane: National Seniors. (35 pages)

Lamont, A. & Sargent-Cox, K. (2017) *Healthy Ageing: The State of the Evidence and available resources*. Brisbane: National Seniors. (51 pages)

McCallum, J. & Rees, K. (2017) 'Silver Economy' Consumer Co-design: An Australian Perspective. In Innovation in *Active, Healthy and Smart Ageing Sector* edited by Guangsheng Guo and Jianbing Liu: Beijing Science & Technology Publishing Press 2017 pp 273-283.

National Seniors and Challenger (2017) *Seniors More Savvy about Retirement Income*. Brisbane: National Seniors. (19 pages)

Rees, K., McCallum, J. & Cantwell, J. (2017) Be Heard: Snapshots of members' views - A report to members from the CEO. Brisbane: National Seniors. (39 pages)

Earl, J.K., Gerrans, P. and Hunter, M. (2017) *Better ways of assessing cognitive health*. Brisbane: National Seniors. (56 pages)

Forthcoming reports:

Use of informed intermediaries: Consumer information sources for mechanisms of choice

Growing older, feeling younger

Downsizing: Movers, planners, stayers

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