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Cognitive change over time

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Key Findings

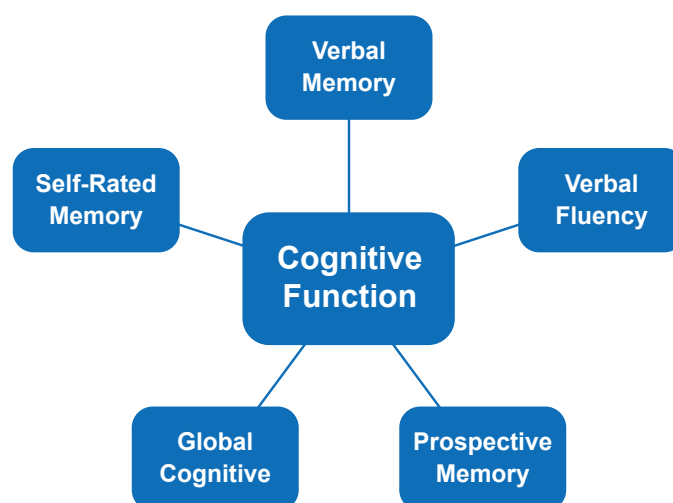
- The majority of older adults continue to perform well on core cognitive tests at an average follow-up of six years, with only minor decreases in task performance.
- There was a slight decline in verbal memory scores observed over time for adults aged 65 years and older. Decline was greatest on the 10-word delayed recall task, and among adults aged 75 and older, who recalled one word less on average at Wave 4 compared to Wave 1.
- Verbal fluency declined across the four waves in adults aged 50 and over. Decline was most pronounced in individuals aged 75 years and older; on average, they named four fewer animals at Wave 4 than at Wave 1.
- There was no decline in prospective memory over time in adults aged 50-64 and 65-74 years. However, the success rate for adults aged 75 and older dropped from 53% at Wave 1 to 40% by Wave 4.
- Older adults who were the most socially integrated at Wave 1 had higher verbal fluency scores initially than adults who were the most isolated, but this difference did not persist over time.
- The proportion of adults aged 50 and older who reported that their memory was 'Fair' or 'Poor' increased from 15% at Wave 1 to almost 20% at Wave 4.
- Seven percent of older adults felt that their memory was continuously declining over the waves. These individuals also had a slightly larger decrease in delayed word recall, verbal fluency, and MMSE scores over the four waves.

8.1 Introduction

As older adults age, there are often changes in certain aspects of cognitive function, which may have implications for performance of everyday tasks, retaining autonomy and independent living at older ages. In The Irish Longitudinal Study on Ageing (TILDA), there are a small number of cognitive tests that form a core component of the computer-assisted personal interview (CAPI) which is delivered by interviewers in the participant's own home. These core tests were administered to participants at every wave of data collection¹ and this affords the opportunity to examine any changes in cognitive function over time or particular patterns within these changes. This is helpful to determine whether there are certain groups of older adults who are more vulnerable to cognitive decline than others.

The core cognitive measures in the CAPI are designed to test several different aspects of cognitive function. Learning and memory are investigated using three separate measures: verbal memory (10-word list learning and recall), prospective memory (remembering to do something at a later point in time) and participants' own perception of their memory functioning (self-rated memory). Executive function is an umbrella term given to a number of cognitive abilities that are required for goal-directed action, including planning, mental flexibility and the ability to suppress inappropriate or incorrect responses (1). In TILDA, executive function is assessed using a verbal fluency task. Global cognitive function is assessed using the Mini-Mental State Examination (MMSE (2)). This is a brief, 30-point test comprising several aspects or domains of cognitive function, including orientation, memory, language, spatial ability, attention and abstract thinking. Further cognitive tests were included as part of the health assessment, which was carried out at Waves 1 and 3, however these measures are not utilised for this Chapter.

Figure 8.1: Measures of cognitive function in the TILDA CAPI.



¹ With the exception of the Mini-Mental State Examination, which formed part of the health assessment at Wave 1 but was included in the CAPI at Waves 2, 3 and 4.

The TILDA Wave 1 Key Findings Report (3) detailed the average performance and difference in performance across age, sex and education for the CAPI cognitive tests and self-rated memory at baseline. The main purpose of this Chapter is to build on those observations by examining change in objective and self-rated cognitive performance from Wave 1 through to Wave 4, by age, sex and education. A further aim is to investigate the change in objective cognitive performance according to how well socially integrated participants were at Wave 1. The degree to which a person is socially integrated rather than isolated can influence their psychological and physical health (4). Furthermore, there is evidence that social engagement may be important for maintaining good cognitive function in later life (5). A final aim is to examine the association between objective cognitive function and self-rated cognitive function, i.e. whether self-rated memory decline reflects an actual change in cognitive performance.

The sample consists of 4,975 adults in the Republic of Ireland aged 50 years or older at Wave 1, who gave a self-interview and answered all of the cognitive elements in the CAPI at each Wave. From Wave 2 onward, in the event that an individual was not physically or cognitively capable of giving an interview, a proxy interview was sought where prior consent had been given for this. This involved someone close to the participant (either a spouse/partner, close relative, friend or carer) answering the questions on their behalf. In the case of a proxy interview, cognitive tests were not administered to the participant, and those individuals are not included in the current analyses. The results presented herein therefore reflect the change in cognitive function over an average of six years among community dwelling adults aged 50 and older, who were physically and cognitively well enough to give an interview at every wave. We have applied statistical weights to account for the fact that certain groups of individuals are less likely to participate in the study at the outset and are also more likely to drop out of the study over time. Findings are presented with respect to differences across waves, age group at baseline (50-64 years, 65-74 years, 75 years and older), sex and education level (none/primary, secondary level, and third level/tertiary education). Changes in cognitive performance according to level of social integration at Wave 1 and self-rated memory decline between waves are also presented.

8.2 Six-year change in objective cognitive performance

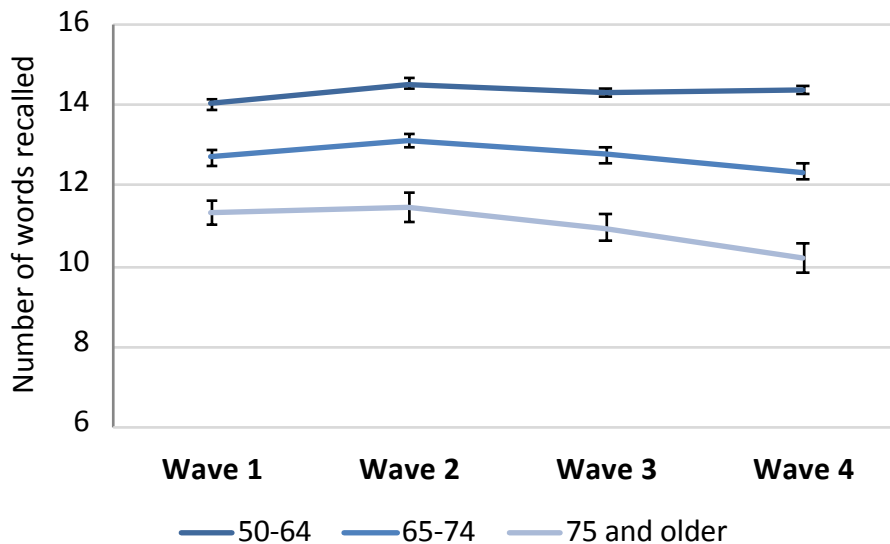
8.2.1 Verbal memory

Verbal memory is particularly susceptible to age-related declines in performance (6, 7) and is one of the aspects of cognitive function most often affected early in mild cognitive impairment and dementia (8). Verbal memory is assessed in TILDA using a 10-word list learning and recall task. Participants hear a list of 10 words and are asked to recall as many words as possible. They immediately hear the same 10 words and are again asked to recall as many

words as possible. The scores from both immediate recall attempts are added together to give an immediate recall total score (range: 0-20 words). Delayed recall is tested after a time delay of approximately 15 minutes when participants are asked to recall the words they heard earlier (delayed recall score, range: 0-10 words).

Performance on the immediate recall task decreased with increasing age with a small decline in performance over time evident in individuals aged 75 years and older (see Figure 8.2). Women performed slightly better than men at all waves (mean: 13.8 words versus 13.2 words). Performance was higher among those with a higher level of education (None/primary = 11.9; secondary = 13.8; third level = 14.9).

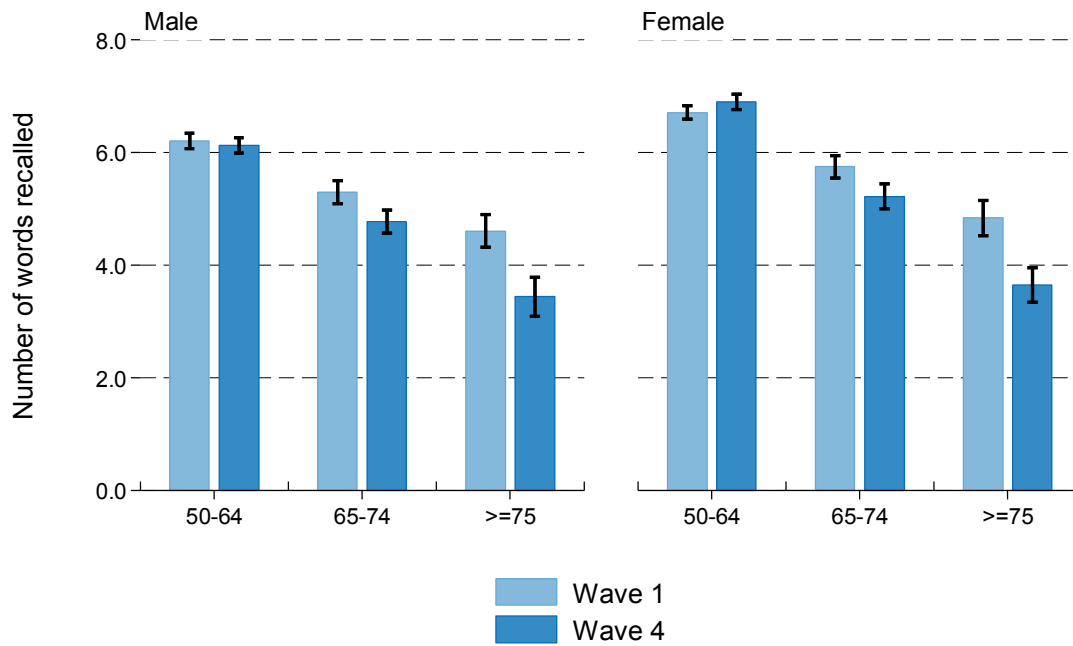
Figure 8.2: Immediate word recall total score across Waves 1 to 4, by age group at baseline.



Error bars correspond to 95% confidence intervals.

A similar pattern of performance on the delayed recall task by age group, sex and wave was observed (see Figure 8.3). The number of words recalled decreased between Wave 1 and Wave 4 among participants aged 65-74 years but more markedly for those aged 75 years and older, amounting to a decrease of about 1 word. Again, women outperformed men, but only among those aged less than 75 years.

Figure 8.3: Delayed word recall score at Waves 1 and 4, by age group and sex.



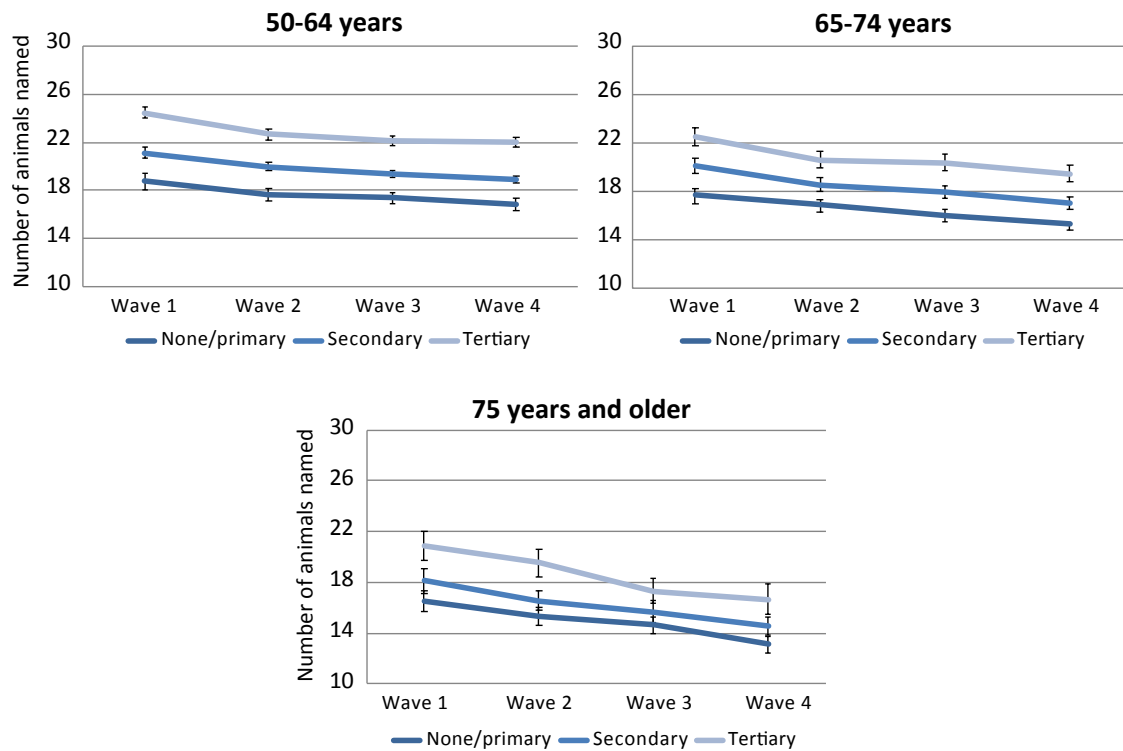
Note. N = 4,975; Error bars correspond to 95% confidence intervals

8.2.2 Verbal fluency

Executive function, which includes planning, mental flexibility and the ability to suppress inappropriate or incorrect responses (inhibition) was assessed using a verbal fluency task. Such tasks typically require participants to generate as many words as possible within a short time period, usually either items belonging to a particular subject category (e.g. animals, foods), or words beginning with a particular letter. Performance is dependent on a variety of executive processes such as self-monitoring, mental flexibility and inhibition, and also on language processing (9, 10). In TILDA, participants were asked to name as many animals as they could in one minute; the total number reflects the verbal fluency score.

Figure 8.4 shows the mean verbal fluency score by age and education level across Waves 1-4. Younger adults and those with higher levels of education named more animals on average than those who were older or had a lower level of education. Despite these age and education gradients, all groups displayed a decline over time in the average number of animals named (the overall change was from 20.6 at Wave 1 to 18.1 at Wave 4), however the decline in performance was greatest for those aged 75 years and older, from a mean of 17.8 words at Wave 1 to 14.2 words at Wave 4. Among individuals aged 75 and older, men performed better than women (16.7 versus 15.5 words), however they experienced a similar decline over time.

Figure 8.4: Verbal fluency score across Waves 1 to 4, by age group and education level.



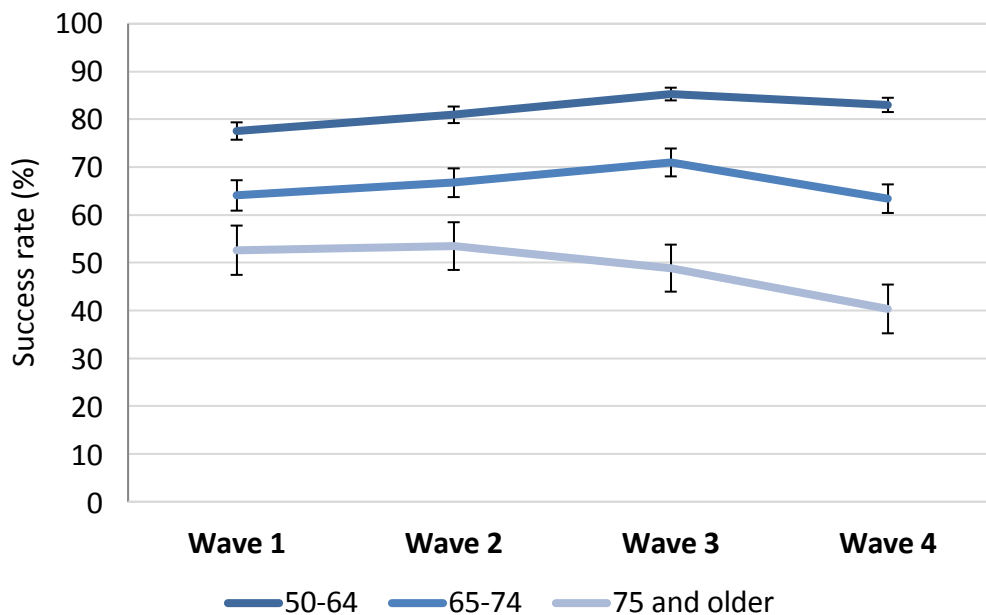
Error bars correspond to 95% confidence intervals

8.2.3 Prospective memory

Prospective memory is the ability to remember to perform an action in the future (11), either at a specific time, or in response to a particular cue. It is a vital skill in order to perform many day-to-day tasks, and as such, is important for maintaining independence in late-life. At an early point in the interview, participants were asked to remember that at a later point, they would be handed a piece of paper and a pen, and that when that occurred, they should write their initials in the top, left-hand corner of the piece of paper. Success on the task was defined as remembering to carry out this action precisely and doing so without receiving a prompt from the interviewer.

Overall success rates differed by age and education level, with higher success rates among younger participants and those with a higher level of education. Among adults aged 75 and older, the success rate declined across the waves from 52.6% at Wave 1 to 40.3% at Wave 4 (see Figure 8.5). However, for those aged 50-64 and 65-74 years, there was an average increase in the probability of success between Wave 1 and Wave 3 suggesting that, at least in the early waves, younger participants may have learned from having carried out the task previously.

Figure 8.5: Percentage of older adults who successfully completed the prospective memory task across Waves 1 to 4, by age group.



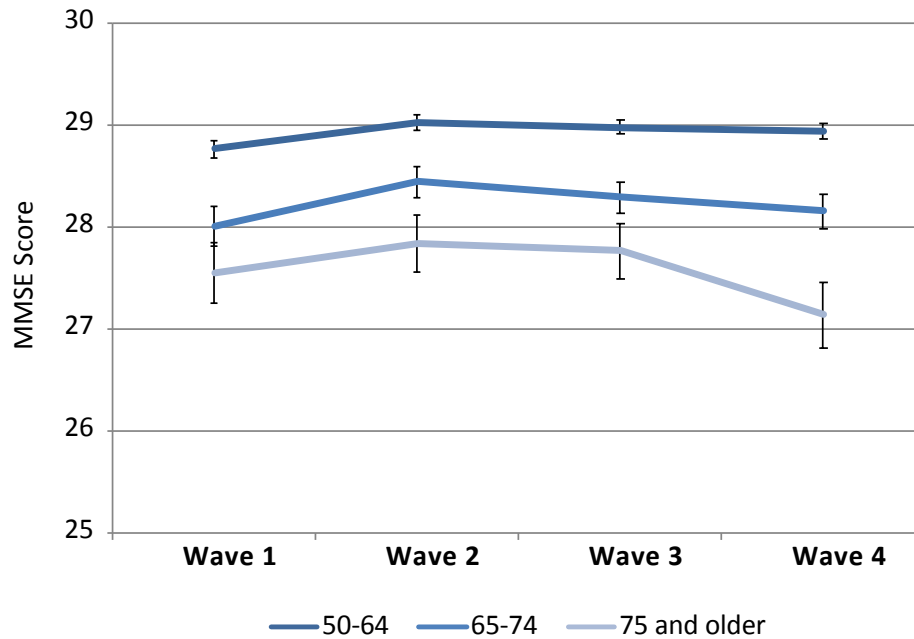
Error bars correspond to 95% confidence intervals.

8.2.4 Mini-Mental State Examination (MMSE)

The MMSE (2) is a 10-minute test of cognitive function and is commonly used as a screening tool for cognitive impairment in hospital settings. The maximum score on the test is 30 points. While it can be useful clinically for identifying individuals who may need more in-depth cognitive assessment, it has been shown to be relatively insensitive to subtle changes over time in community-dwelling older adults.

Figure 8.6 displays mean MMSE scores across the four waves by age group. Individuals aged 50-64 performed better on this task at all waves, relative to individuals aged 65-74 years and 75 years and older. However, there was no significant change in scores over the average six year follow up for any age group. Women and men performed similarly on the task. Scores were greater among those with a higher level of education (none/primary = 27.6; secondary = 28.8; third level = 29.2), but change in performance over time did not differ according to education level.

Figure 8.6: Mini-Mental State Exam (MMSE) score across Waves 1 to 4, by age group.



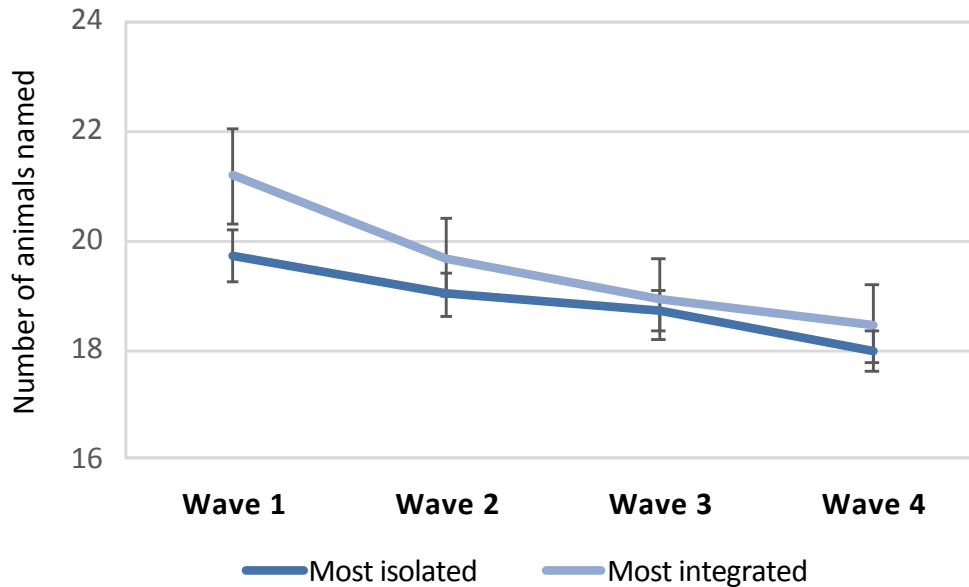
Error bars correspond to 95% confidence intervals. Note reduced n of 4,137 participants.

8.3 Change in cognitive performance by level of social integration

Social integration is assessed at Wave 1 using the Social Network Index (12). The scale measures the extent to which an individual has meaningful personal ties to friends and family and social ties to community. This takes into account whether an individual is married/cohabiting, the number of close friends and relatives they have, and whether they are involved in any community, church groups or charitable organisations. Individuals are grouped into four categories: 'most isolated', 'moderately isolated', 'moderately integrated' and 'most integrated'.

Figure 8.7 shows mean verbal fluency scores by wave and level of social integration. Compared to older adults who were the most socially isolated, individuals who were the most socially integrated named more animals at Wave 1 (21.2 versus 19.7). However, both groups declined in performance over the subsequent waves, and the difference between the groups was no longer evident by Wave 2. There were no significant differences in word recall performance, prospective memory or MMSE scores between social integration groups at any wave.

Figure 8.7: Verbal fluency score across Waves 1 to 4, by level of social integration at Wave 1.



Error bars correspond to 95% confidence intervals.

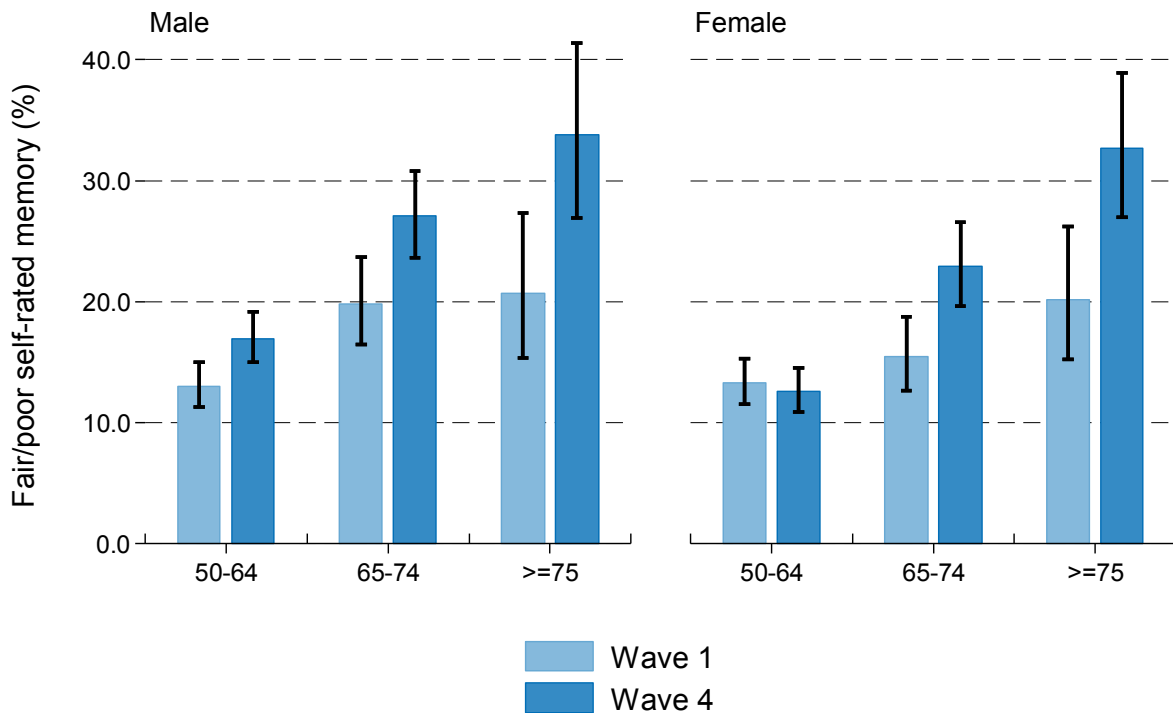
8.4 Self-rated memory ability and memory decline

Older adults' subjective assessment of their own cognitive functioning can be influenced by many factors. These include age and actual cognitive ability (typically measured objectively by cognitive testing), but also how old a person 'feels' (13), their physical health, mood, anxiety and personality (14). Concerns about memory and cognitive ability are common in older adults (15). In addition to this, self-rated memory decline, defined as the self-perception of a deterioration of memory functioning, can be indicative of actual or future change in performance on cognitive tests (16, 17).

8.4.1 Self-rated memory

Older adults in the study were asked at each Wave to rate their current memory ability on a 5-point scale: either 'Excellent', 'Very good', 'Good', 'Fair', or 'Poor'. Across all waves, on average, 82% of older adults felt that their memory was good, very good, or excellent. However, there was an increase over time in the proportion of older adults who self-reported fair or poor memory from 15.1% at Wave 1 to 19.5% at Wave 4. Figure 8.8 shows the percentage of participants who reported fair/poor memory at Waves 1 and 4 by age group and sex. The proportion reporting fair/poor memory increased with age, and among those aged less than 75 years, it was higher in men than women. However, the increase in self-reported fair/poor memory between Wave 1 and Wave 4 was greater in women. A similar trend was evident for men but did not reach statistical significance.

Figure 8.8: The percentage of older adults with fair/poor self-rated memory, at Waves 1 and 4, by age group and sex.



Note. N = 4,975; Error bars correspond to 95% confidence intervals

The proportion of participants with fair/poor self-rated memory also differed by level of education, from 25.8% of older adults with none/primary level education to 11.5% of those with third level education. There was a slight increase in the proportion reporting fair/poor memory over time among those participants with none/primary or secondary education, but no change for those with third level education.

8.4.2 Self-rated memory decline

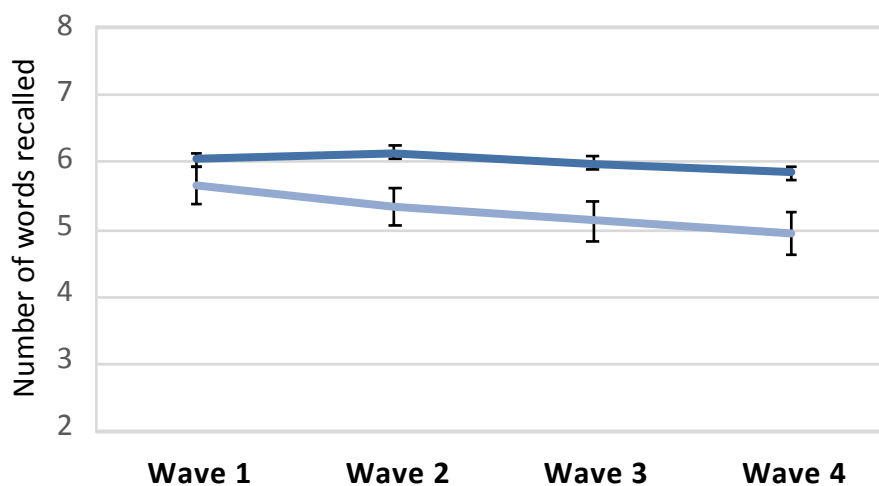
At Waves 2, 3 and 4, in addition to being asked to rate their current memory ability, participants were also asked if they felt that their memory had changed i.e. whether it was better, the same, or worse than at the previous interview. The proportion of older adults who indicated at any of Waves 2, 3 or 4 that their memory had declined since the previous interview was high, at 42%. However, only 7% of adults reported persistent memory decline i.e. a decline at all three waves. The percentage of participants with persistent self-rated memory decline increased with age from 5% of adults aged 50-64 years to 14% of participants aged 75 years and older. However, there was no difference between men and women or by level of education.

8.4.3 The relationship between objective cognitive test performance and self-rated memory decline

Older adults with persistent self-rated memory decline had a lower immediate recall total score than those who did not report persistent decline, recalling on average one word fewer. There was also a trend for this group to decline faster across waves but this was not statistically significant.

Figure 8.9 displays the average delayed word recall score across waves and by self-reported persistent memory decline. At all waves, participants who felt that their memory was continually declining had lower scores than those who did not feel this way. Furthermore, these individuals had a greater average decrease in performance on the delayed recall task over the six-year period, although the magnitude of this decline was less than 1 word.

Figure 8.9: Delayed word recall score across Waves 1 to 4, by persistent self-rated memory decline.



Note: No persistent decline = No self-reported memory decline or self-reported memory decline at one or two Waves only; Persistent decline = self-reported memory decline at all three Waves (i.e. Waves 2, 3 and 4). Error bars correspond to 95% confidence intervals.

In the verbal fluency task, individuals with persistent self-rated memory decline named an average of 18.4 animals, compared with 19.3 for participants with no persistent decline. The decline in verbal fluency score across waves was also greater for those with persistent decline from 20.6-16.9 (Table 8.1). This 4-point drop in score contrasts with a 2-point drop in those with no persist decline. On average, 35% of participants with persistent self-rated memory decline failed the prospective memory task compared with 25% of all other participants; however, their performance did not decline between Waves 1 and 4.

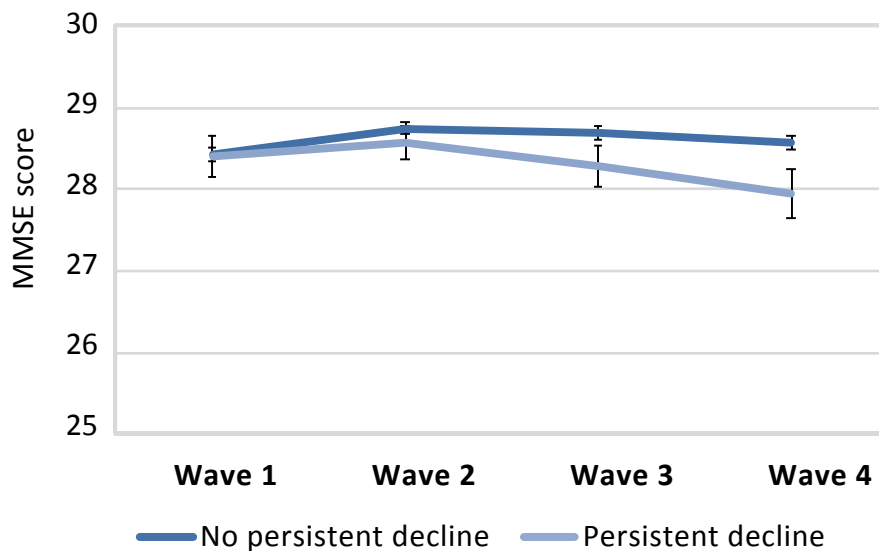
Table 8.1: Verbal fluency score across Waves 1-4, by persistent self-rated memory decline.

(N = 4,975)	Mean number of animals named			
	Wave 1	Wave 2	Wave 3	Wave 4
No persistent decline	20.6	19.4	18.7	18.2
Persistent decline	20.6	18.3	17.8	16.9

Note: No persistent decline = No self-report memory decline or self-report memory decline at one or two Waves only; Persistent decline = self-reported reported decline at all three Waves (i.e. Waves 2, 3 and 4).

Figure 8.10 shows MMSE scores across Waves 1 to 4 by persistent self-rated memory decline. There were no differences in baseline score between groups, but by Waves 3 and 4 a small difference in performance, of approximately half a point on average, was evident.

Figure 8.10: Mini-Mental State Examination (MMSE) score across Waves 1 to 4, by persistent self-rated memory decline.



Note: No persistent decline = No self-reported memory decline or self-reported memory decline at one or two Waves only; Persistent decline = self-reported reported decline at all three Waves (i.e. Waves 2, 3 and 4).

N = 4,137.

8.5 Discussion

This Chapter explored the change in cognitive function over four waves: between baseline and an average of six-years follow up. Overall, there was little change in cognitive function across the four waves, particularly in adults who were aged less than 75 years at Wave 1. The greatest evidence of decline in performance was in verbal memory, verbal fluency and prospective memory among adults aged 75 and over. The overall level of cognitive performance was impacted by education whereby individuals who had more years of formal education consistently performed better on the tasks than those who had received

less education. The sex of participants also affected performance on the immediate and delayed recall tasks with women recalling more words than men. Conversely, men in the oldest age group performed better than women on the test of verbal fluency. Despite these overall differences by education level and sometimes by sex, neither characteristic affected whether or by what degree, cognitive performance changed over time.

The observation of only small changes in performance on the cognitive tests over six years is a positive finding. It is likely, in part, reflects the fact that adults recruited at baseline were community dwelling, and that the current analysis was carried out only on adults who were interviewed in person at all four waves, and so does not include proxy interviews. Therefore, in general, the results reflect individuals without severe cognitive impairment. In addition, as the majority of TILDA participants are still relatively young, we would not expect much cognitive decline to have occurred, even after six years. We did however, observe a small decline in cognitive function in those aged 75 years and over at baseline. This is in keeping with international evidence, which suggests acceleration in cognitive decline, at least in some domains, from age 75-80 years onwards (e.g. (18, 19)). Nonetheless, the average drop in test scores between waves was small, suggesting that for most individuals, this would likely have a negligible effect on their everyday functioning. The lack of significant decline among those aged less than 75 years at baseline is evidence that the majority of community dwelling older adults in their 50s, 60s and early 70s function very well. This lends support to recent European Union policy initiatives to extend working lives, and to the move by the Irish government in particular, to raise the state pension age to 68.

Social engagement and social participation are associated with better health in later life and evidence suggests that they may help to reduce deterioration in cognitive abilities with age (5, 20). Our results show that while there was an initial difference in verbal fluency according to how socially integrated adults were at Wave 1, this difference did not persist across waves.

By Wave 4, there was an increase in the proportion of participants who self-reported their memory as fair or poor, and this increased with age. Although there are many factors that influence self-rated memory on any given occasion, evidence increasingly suggests that subjective memory decline can predict the future development of mild cognitive impairment and/or dementia (21, 22). While a high proportion of adults reported at some point that they felt their memory had declined since the previous wave, only a small percentage of adults reported persistent memory decline wave on wave. Self-reported persistent decline over a period of years may be important in predicting future dementia risk (23), and this group also showed a decline in verbal fluency, delayed recall and MMSE scores over time.

Once again, however, the size of these decreases was small, indicating that at the group level, there was no major deterioration in cognitive abilities over the six years.

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