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Cognitive impairment and self-reported health outcomes among older adults: Longitudinal evidence from Australia

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ABSTRACT

Background: Australia's population is ageing, with forecasts indicating that individuals aged 65 years and over will account for >20 % of the total population by 2066. Ageing is strongly linked with a significant decrease in cognitive capabilities. This study aimed to explore the association between cognitive impairment and four types of health outcomes among older Australians.

Methods: Data used for this study was collected from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. The final analysis consisted of 11,146 person-year observations from 7035 unique individuals from Wave 2012 and Wave 2016, respectively. A longitudinal random-effects generalised least squares, and ordered logistic regression were used to analyse the association between cognitive impairment and health outcomes.

Results: The study results suggest that cognitive impairment was negatively associated with general health, mental health, self-assessed health and health satisfaction. Older Australians with cognitive impairment scored lower on general health ($\beta = -2.82$, SE = 0.56), mental health ($\beta = -2.93$, SE = 0.53), self-assessed health ($\beta = -0.75$, SE = 0.10), and health satisfaction ($\beta = -0.19$, SE = 0.09) compared to the counterparts without cognitive impairment. The heterogeneous results also showed cognitive impairment was associated with poor health outcomes across age groups.

Conclusion: This study found evidence that cognitive impairment is associated with poor health outcomes. To enhance the physical and mental health and well-being of older adults, the community, government and non-government organizations, and other stakeholders should prioritize routine healthcare prevention, targeted interventions, and treatment practices, particularly for individuals with or at risk of cognitive impairment.

1. Introduction

The global population's demographic composition is transitioning towards an older age profile due to advancements in life expectancy (Ataollahi Eshkoor et al., 2015). With increasing life expectancy, the quality of life of older individuals has become an important societal concern. Cognitive impairment, which significantly affects the quality of life due to diminishing capabilities and skills, is a key factor in this context (Comijs et al., 2005). As individuals age, they are more likely to experience cognitive decline in areas such as thinking, memory, and concentration, reflecting the physiological changes that occur in the brain and body (Pais, Ruano, Moreira, et al., 2020). Declines in cognitive skills such as memory, attention, orientation, language, and executive function may adversely affect many dimensions of a person's life (Pan et al., 2015). For example, diminished verbal abilities can result in communication challenges, limiting an individual's capacity to sustain social roles at preferred levels (Kiely, 2014). Moreover, attention impairments may lead to physical limitations, self-reported disabilities (Ble et al., 2005), and difficulties in performing daily activities such as eating, bathing, and maintaining personal hygiene (Bronnick, 2006). Additionally, deficits in attention, memory, and executive function may contribute to the mechanisms underlying chronic pain (Attal et al., 2014).

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A potential challenge in addressing memory concerns and cognitive impairment in healthcare and related research is accurate identification and measurement of these conditions (Molinuevo et al., 2017). Cognitive impairment differs from normal ageing in the extent of its impact on everyday functioning. While normal ageing involves mild, gradual changes like occasional forgetfulness and slower processing speed, cognitive impairment includes more noticeable and persistent issues, such as frequent memory lapses, poor judgment, and difficulties with language and daily tasks (Grundman, 2004). People with cognitive impairment do show a clear decline in cognition based on objective assessments. However, this cognitive decline is not severe enough to interfere with daily activities or meet the diagnostic criteria for dementia (Gauthier et al., 2006). Cognitive impairment represents an intermediary stage, falling between the typical cognitive decline associated with ageing and the more pronounced decline characteristic of dementia (Reisberg et al., 2008; Wang et al., 2014). The risk of developing dementia is markedly higher for individuals with mild cognitive impairment compared to the general population (Petersen et al., 2014), with an annual progression rate estimated between 10 % to 15 % (Farias et al., 2009; Xue et al., 2017). Cognitive impairment, encompassing mild impairment to dementia (severe cognitive impairment), is commonly associated with ageing (Keramat et al., 2023). The age at which the risk of cognitive decline associated with ageing begins to affect cognitive capacities is a topic of ongoing debate (Finch, 2009; Nilsson et al., 2009; Salthouse, 2009). Nevertheless, longitudinal data has demonstrated that cognitive decline is observable across all age groups ranging from 45 to 70 years, with a more rapid decrease observed in the oldest age cohort, those aged 70 years and above (Singh-Manoux et al., 2012). The global rate of incidence of cognitive impairment among adults aged over 50 years varies significantly, ranging from 5.1 % to a staggering 41 %, with a median prevalence of 19.0 % (Pais, Ruano, & P. Carvalho O, Barros H., 2020). Estimates show that among older Australians (65 years and over), the rate of cognitive impairment varies substantially, ranging from 7.7 % to 33.3 % in various settings (Anderson et al., 2007; Low et al., 2004). The global prevalence of severe cognitive impairment is projected to reach 82 million by 2030 and increase further to 152 million by 2050 (WHO, 2017; WHO, 2019). Given the significant public health burden of cognitive impairment, comprehensive health assessments are crucial for early identification and intervention. These assessments should ideally include a range of measures, such as cognitive function tests (e.g., memory tests, neuropsychological assessments) in addition to self-reported health outcomes (National Institute on Aging, 2020). Self-reported health outcomes are important because they provide insights into an individual's perceived well-being, quality of life, and functional status, which are not always captured by objective tests (Jylhä, 2011). They also reflect the subjective experience of health, including symptoms and the impact of cognitive impairment on daily life, enabling a more holistic understanding of an individual's condition (National Institute on Aging., 2020). Early detection allows for timely interventions, including lifestyle modifications, cognitive training, and pharmacological therapies, which may help to slow cognitive decline and improve quality of life (National Institute on Aging., 2021).

Self-assessed health outcome is a frequently employed metric for evaluating overall health that captures individuals' subjective assessment of their own health at a given point of time. Assessing the health status is essential for determining variations within and across groups, monitoring changes over time, and evaluating the effectiveness of health interventions (Sibthorpe et al., 2001). Evidence suggests that self-reported health is an independent and valid indicator of health, even for those in the early stages of dementia or mild cognitive impairment (Walker et al., 2004). Prior studies have measured self-reported health outcomes using measures such as general health (Dwyer-Lindgren et al., 2017; Lee, 1978), mental health (Lee, 1978), self-assessed health (Hu et al., 1978) and health satisfaction (Paul et al., 2016).

Cognitive impairment is associated with a multitude of adverse health outcomes, encompassing an elevated mortality risk, an increased likelihood of developing dementia, heightened rates of disability and hospitalization, as well as deterioration in overall health-related quality of life (Chen et al., 2022; Keramat et al., 2023; Pike et al., 2022). Prior studies found that cognitive impairment is associated with the deterioration in physical performance, such as activities of daily living and instrumental activities of daily living (Atkinson et al., 2007; Tabbarah et al., 2002; Wang et al., 2002). Moreover, cognitive impairment is a major risk factor for depression, anxiety, and other mental health conditions (Yates et al., 2013). Furthermore, a recent study found that individuals with cognitive disorders, such as autism, attention deficit, and memory loss, exhibit lower levels of satisfaction with their health status compared to the general population (Stone et al., 2023).

Understanding the link between cognitive impairment and health outcomes holds significance because of its far-reaching implications. This will help healthcare providers accurately predict and manage the needs of affected individuals, potentially delaying the progression of the condition and improving overall health and well-being. There is evidence that approximately 40 % of individuals with cognitive impairment had medical practitioners who were unaware of their condition (Chodosh et al., 2004). Failing to assess cognitive or memory problems can impede the treatment of underlying diseases and co-occurring disorders, and it can pose a risk to the patient and others (Bradford et al., 2009). Additionally, cognitive impairment is often associated with a greater likelihood of experiencing other health concerns, such as cardiovascular diseases (Leng et al., 2018) and mental health disorders (Mirza et al., 2017), making early detection and intervention essential for preventing further complications. Cognitive impairment may also have a substantial influence on an individual's capacity to manage their own health effectively. Challenges related to adhering to medicine, following treatment plans, and comprehending medical information can all be worsened by cognitive decline (Smith et al., 2017). Furthermore, patients with cognitive impairment are at increased risk for adverse hospital experiences, including but not limited to confusion, distress, and trouble following directions or interacting with healthcare workers (Australian Commission on Safety and Quality in Health Care, 2019). Therefore, investigating the relationship between cognitive decline and health outcomes will allow healthcare practitioners to develop improved communication and support systems. This, in turn, can improve health outcomes for individuals with cognitive impairment.

The findings of this study will play a crucial role in guiding the development of evidence-based interventions to promote independence and healthy ageing. The growing population of older Australians has significant benefits and opportunities for Australia as it steadily expands to provide a substantial and expanding consumer base for a broad spectrum of healthcare products and services. For instance, an increase of 5 % in the employment rate of Australians aged 55 and over would result in a significant increase of $48 billion in national income annually (Deloitte Access Economics., 2012). Though cognitive impairment is more likely to progress to dementia, it can sometimes revert to normal or not advance further. There is evidence that as many as 44 % of individuals who initially exhibit mild cognitive impairment are expected to be back to their normal cognitive functioning within one year (Wada-Isoe et al., 2012). Therefore, early detection of cognitive impairment can enable more effective management, improved quality of life, and planning for the future, even if complete reversal of normal ageing may not be possible in all cases.

There is a lack of comprehensive Australian research that investigating the relationship between cognitive impairment and various health outcomes. A prior study revealed that older adults with cognitive decline face a higher risk of encountering various negative outcomes during hospital stays (Fogg et al., 2018). Another study revealed that individuals with cognitive impairment experienced a lower health-related quality of life (Keramat et al., 2023). To the best of our knowledge, no previous Australian study has explored the association between cognitive impairment and a wide array of health outcomes using nationally representative longitudinal data. Therefore, the purpose of this research is to investigate the following hypotheses: (1) Cognitive impairment is negatively associated with the general health of older Australians. (2) Cognitive impairment is associated with a decline in self-reported mental health among older Australians. (3) Older adults with cognitive impairment are more likely to report lower levels of self-assessed health. (4) Cognitive impairment is negatively associated with self-reported health satisfaction.

2. Methods

2.1. Data source

This research utilizes data collected from the Household, Income and Labour Dynamics in Australia (HILDA) Survey, initiated in 2001. The HILDA dataset encompasses a broad spectrum of variables, including wealth, labour market experiences, household dynamics, fertility, health status, and educational attainment. Choosing the initial sample involved a multistage sampling procedure. Initially, 488 Census Collection Districts (CDs) were selected by a probability proportional to size sampling technique. Every district has a range of 200 to 250 dwellings. Furthermore, a random selection of 22–34 houses was made from each CDs. Ultimately, a total of 12,252 households were selected, with a maximum of three homes picked from each residence. Commencing in 2001, the annual data collection for the HILDA Survey has included a representative sample of individuals aged 15 years and over residing in households. Data collection was carried out by trained interviewers through face-to-face and telephone interviews. In this case, a self-administered questionnaire was utilized, adhering to the ethical principles established by the University of Melbourne. As time progressed, the sample size increased. The household includes all children born or adopted by the participants, and anyone new who joins the household because the original families changed. Therefore, the survey encompasses an annual average of approximately 17,000 individuals residing in Australia. The sampling technique, research design, and data-collecting procedures for the waves have been thoroughly examined elsewhere (Wooden et al., 2002).

2.2. Study participants

To focus on cognitive impairment, we restricted our analysis to data from the HILDA Survey waves 12 (2012) and 16 (2016), as these were the only waves with relevant questions. Wave 16 was utilized as the follow-up survey, while wave 12 was considered as the baseline. The analytic samples were restricted to older adults residing in Australia, defined as individuals aged 50 years or older. The study omitted participants who did not provide comprehensive information regarding the exposure factors (cognitive impairment test scores) and the outcome variables (general health, mental health, self-assessed health, and health satisfaction). The final analytic sample comprises 11,146 person-year observations from 7035 unique individuals. Fig. 1 provides a detailed dissection of any missing data and outlines the criteria that were employed to exclude specific observations.

2.3. Outcome variables

We utilized four distinct variables to measure health outcomes. We measured health outcomes through general health, mental health, self-assessed health, and health satisfaction. This study used the SF-36 Health Survey to measure general and mental health. General health score is generated using 10 questions from the SF-36 health survey. The data encompass participants' self-perceptions of their overall health, emotional state, and level of independence in carrying out daily activities. The raw scores were transformed into a scale of 0 to 100, where a higher number signifies a better level of general health. Mental health score is derived using five specific questions from the SF-36 health survey. These questions assess the degree to which mental health issues impact everyday tasks on an emotional level. The mental health index is derived using the same methodology as the general health index and

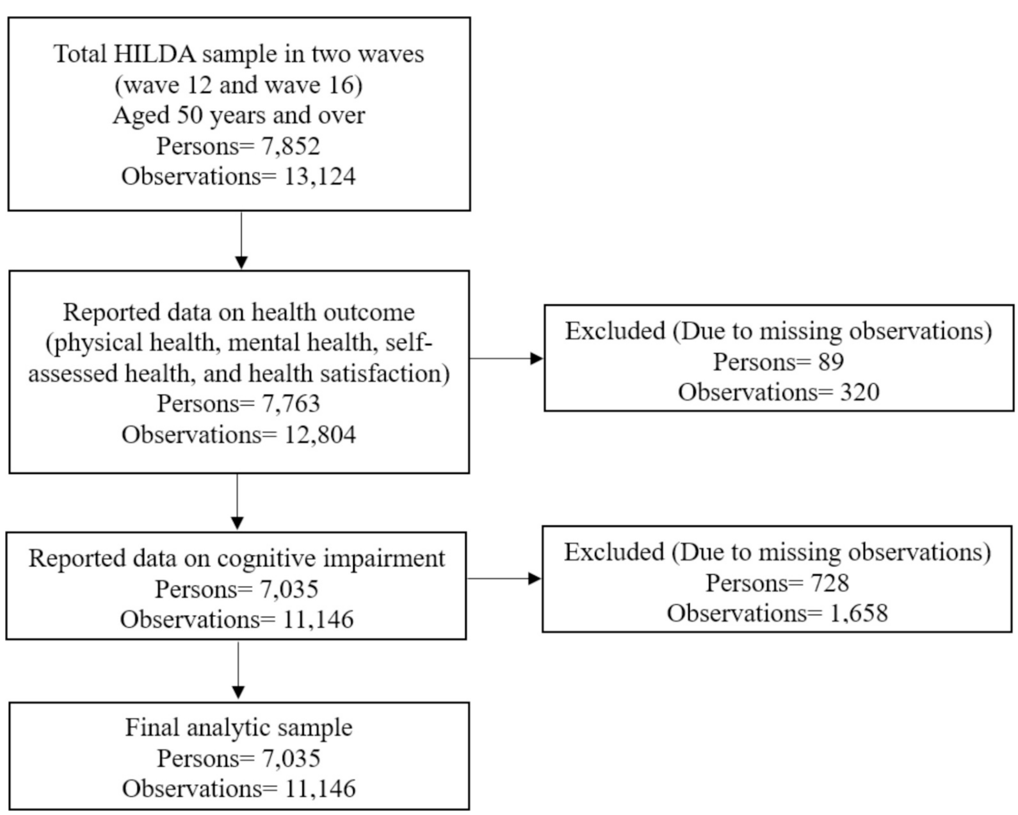

Fig. 1. Participants flow into the analytic sample and missing data.

ranges from 0 to 100, with higher scores indicating better mental health. The study used self-assessed health as the third measure to evaluate health outcomes. This was determined by asking participants the question: "In general, would you say your health is?" In the HILDA Survey, participants' responses were recorded on a scale ranging from "1 = Excellent" to "5 = Poor". The final index used to assess health outcomes was health satisfaction, which was determined by answering the question: "All things considered, how satisfied are you with your health?" Participants rated their health satisfaction on a scale from 0 to 10, with higher scores indicating greater satisfaction.

2.4. Exposure variable

The HILDA Survey evaluates the cognitive capabilities of participants by using validated measures of cognitive function. These tests are simply integrated into the HILDA's in-person survey questionnaires. The survey measured cognitive function of an individual using the Symbol Digit Modalities Test (SDMT) and the Backward Digit Span Test (BDS). While the BDS and SDMT provide valuable information about core cognitive functions, they may not comprehensively assess the cognitive profile of individuals, particularly for determining cognitive impairment without specific cutoff scores. More comprehensive neuropsychological assessments, such as the Montreal Cognitive Assessment (MoCA) (Nasreddine et al., 2005), Mini-Mental Status Examination (MMSE) (Folstein et al., 1985), or Saint Louis University Mental Status (SLUMS) examination (Morley & Tumosa, 2002) offer a more nuanced and reliable assessment of cognitive function. However, due to the unavailability of such tests scores in the HILDA Survey, we relied on the BDS and SDMT to assess a person's cognitive health. The tests have previously been used to detect cognitive impairment in individuals diagnosed with multiple sclerosis (Parmenter et al., 2007; Van Schependom et al., 2014) and those who are currently hospitalized (Leung et al., 2011). The BDS cognitive evaluation exam requires individuals to recite a sequence of numbers in the opposite order (Lamar et al., 2007). The BDS evaluates the cognitive capacity of working memory on a scale of 0 to 8. The SDMT is a cognitive assessment tool that measures processing speed and attention. During the SDMT, participants are instructed to match a list of numbers with corresponding geometric shapes as quickly and accurately as possible (Smith, 1973). The SDMT evaluates the cognitive function of the central brain and provides scores that range from 0 to 110.

The threshold for cognitive impairment in this study was determined based on established criteria from previous literature. Specifically, earlier studies have classified cognitive impairment using the following thresholds: individuals scoring ≥1.0 standard deviation (SD) below the mean on either the BDS or SDMT (or both) tests were categorised as having mild cognitive impairment, while those scoring ≥1.5 SD below the mean on both tests were classified as having severe cognitive impairment (Aschwanden et al., 2020; Haque et al., 2024a; Keramat et al., 2023). In this study, we combined the categories of mild and severe cognitive impairment and focused on cognitive impairment as a single construct. Accordingly, we defined cognitive impairment as scoring ≥1 SD below the mean on both the BDS and SDMT. This approach reflects an empirical threshold used in prior research while ensuring alignment with the study's objectives. Based on this criterion, individuals were classified as cognitively impaired if they scored ≤3 on the BDS and ≤ 30 on the SDMT.

2.5. Control variables

We included a range of individual-level socio-demographic factors, health-related behaviors, and health characteristics as covariates. The socio-demographic characteristics included age (50–64 years, and ≥ 65 years), gender (male, and female), marital status (unpartnered and partnered), highest level of education (year 12 and below, professional qualifications, and university qualifications), annual household disposable income (Quintile 1 [poorest], and Quintile 5 [richest]), participation in the labour force (employed, and unemployed or not in the labour force), Indigenous origin (not of Indigenous origin, and Aboriginal or Torres Strait Islander or both), geographic residency (major city, and regional city or remote area). In addition, three behavioural characteristics that can impact health outcomes were included: smoking habits (non-smoker, and currently smoking), alcohol drinker (non-drinker, and current drinker), and physical activity (less than the recommended level, and recommended level). Furthermore, Body Mass Index (underweight, healthy weight, overweight, and obese) and disability status (no versus yes), were considered as the proxy of participants' health status.

2.6. Estimation strategy

An unbalanced longitudinal data set was constructed, comprising of 11,146 person-year observations from 7035 distinct individuals. The descriptive statistics for continuous variables were presented in the subsequent statistical analysis as means and standard deviations (SD), while frequencies and percentages were utilized for categorical variables. Four distinct regression models were constructed to investigate the associations between cognitive impairment and health outcomes.

The first two outcome variables, general health and mental health, were measured on a continuous scale. Therefore, we applied a longitudinal random-effects GLS regression model to analyse the association between cognitive impairment and general health and mental health. This model is employed to assess the effects of time-varying variables when analysing longitudinal data (e.g., cognitive impairment) and fixed individual characteristics (e.g., gender). This model offers an approximation of the between-person differences in the effects. Furthermore, this model assumes random variability among individuals, which is not influenced by model covariates.

The random-effects GLS regression can be expressed in the following functional form:

$$HO_{it} = \alpha + \beta_1 CI_{it} + \beta_2 Z_{it} + \mu_i + \epsilon_{it} \quad (1)$$

HO denotes the two different types of health outcome variables which were continuous variables in nature: general health, and mental health. CI is exposure variable cognitive impairment. Z_{it} represents the vector consisting of time-varying and time-invariant control variables. The model parameter of interest to be estimated is denoted as β_1, and β_2 indicates the vector of coefficient while α is the model's grand intercept. The analysis considers two parts of the error: individual-specific components, μ, which stays the same over time, and time and person-specific error, ϵ_{it}, which is assumed to be uncorrelated with the independent variables.

The third and fourth outcome variables were self-assessed health and health satisfaction, respectively. These variables were measured on an ordinal scale. Self-assessed health is categorised from "1 = Poor" to "5 = Excellent", while health satisfaction is categorised from 0 to 10, where a higher value indicates a better level of satisfaction with their health. Hence, we applied the random-effects ordered logistic regression model to analyse the association between cognitive impairment and, self-assessed health, and health satisfaction.

The random-effects ordered logistic regression can be expressed in the following functional form:

$$Y^*_{it} = \mu + X'_{it}\beta + \varepsilon_{it.}$$

$$= \mu + X'_{it}\beta + \alpha_i + \nu_{it}, i = 1, 2, \ldots\ldots, N; t = 12, 16 \quad (2)$$

Where the distribution of α_i and ν_{it} are assumed respectively to be $\alpha_i \sim$ i.i.d $[0, \sigma_a^2]$ and $\nu_{it} \sim$ i.i.d [0,1]. X'_{it} is a vector of observable time-invariant and time-varying factors including cognitive impairment, socio-demographic characteristics and other control variables. μ is the non-random intercept, β is the vector of coefficients and ε_{it} is the error term.

Statistical significance was determined using a *p*-value threshold of

0.05. Lower *p*-values (<0.01 and < 0.001) were reported to indicate stronger evidence of significance. Stata version 17.0 (StataCorp LLC, College Station, TX: USA) was employed for all statistical analyses.

3. Results

Table 1 provides an overview of the study sample. The mean scores for general health and mental health in the pooled data were 63.72 and 76.18 on a scale of 100, respectively. The mean self-assessed health score was 3.12 on a scale of 1 to 5, whereas the mean health satisfaction score was 6.96 on a scale of 0 to 10. The results also showed that 11.79 % were cognitively impaired. Furthermore, approximately over two-fifths (42.24 %) were aged 65 or older, more than half (53.20 %) were female, nearly two-thirds (64.35 %) were partnered, nearly a quarter (23.50 %) had a university degree, over half (53.37 %) were either unemployed or not in the labour force, the majority (98.08 %) were not of Indigenous origin, and roughly two-thirds (63.74 %) resided in major cities. Table 1 additionally presents the following information regarding the pooled sample: 87.45 % were non-smokers, 81.04 % were current drinkers, 67.47 % does not perform the recommended level of physical activity, 28.67 % were obese, and 42.31 % had a disability (pooled data).

Fig. 2 depicts the mean scores for general health, mental health, self-assessed health, and health satisfaction throughout the study periods. The result indicates a minor variation in the mean general health score, decreasing from 63.89 in 2012 to 63.57 in 2016. The average mental health score of older Australians fell from 76.46 in 2012 to 75.93 in 2016. Furthermore, the mean health satisfaction score of participants declined slightly from 6.97 to 6.96 in 2012 and 2016, respectively. However, the mean self-assessed health score rose marginally from 3.12 (2012) to 3.13 (2016) during the study period.

Fig. 3 illustrates the rate of older Australians with cognitive impairment in the study sample from 2012 to 2016. The figure shows that the percentage of older Australians with cognitive impairment declined from 13.10 % in 2012 to 10.60 % in 2016.

Fig. 4 depicts the mean health outcomes—general health, mental health, self-assessed health, and health satisfaction—stratified by cognitive impairment status among older Australians from 2012 to 2016. The figure illustrates that older Australians with cognitive impairment scored lower across all four health outcomes—general health, mental health, self-assessed health, and health satisfaction—compared to those without cognitive impairment. For instance, in Wave 16, the mean scores for general health, mental health, self-assessed health, and health satisfaction were 64.76, 76.49, 3.19, and 7.03, respectively, among individuals without cognitive impairment, compared to 53.46, 71.14, 2.62, and 6.34 among older adults with cognitive impairment.

Table 2 shows the regression results obtained from the random-effects GLS and random-effects ordered logistic regressions that explicitly showed the relationships between cognitive impairment and different facets of health outcomes. The results showed that participants with cognitive impairment had significantly lower health outcomes (general health, mental health, self-assessed health and health satisfaction) compared to those without cognitive impairment in all four regression models (models 1–4). In the case of general and mental health, participants with cognitive impairment exhibited a decrease of −2.82 points ($\beta = -2.82$, SE = 0.56) (model 1) and − 2.93 points ($\beta = -2.93$, SE = 0.53) (model 2) compared to those without cognitive impairment. The results from models 3 and 4 showed that participants with cognitive impairment had significantly lower self-assessed health ($\beta = -0.75$, SE = 0.10), and health satisfaction ($\beta = -0.19$, SE = 0.09), respectively, compared to those without cognitive impairment. In addition to cognitive impairment, several other socioeconomic, lifestyle, and demographic variables were found statistically significant. For instance, individuals from the poorest household disposable income (quintile 1), unemployed or not in the labour force, smokers, obese, or those with disability had lower general health, mental health, self-

Table 1
Distribution of the analytic sample (outcome, and exposure variable: Baseline, Final, and Pooled across all waves (Persons = 7035, Observations = 11,146).

	Baseline Wave (2012)		Final Wave (2016)		Pooled in all Waves (2012–2016)	
Characteristics	n	mean/%	n	mean/%	n	mean/%
Outcome variables (Self-reported health)						
General health	5410	63.89	5736	63.57	11,146	63.72
Mental health	5410	76.46	5736	75.93	11,146	76.18
Self-assessed health	5410	3.12	5736	3.13	11,146	3.12
Health satisfaction	5410	6.97	5736	6.96	11,146	6.96
Exposure variable						
BDS	5410	4.77	5736	4.84	11,146	4.81
SDM	5410	41.68	5736	42.84	11,146	42.27
Cognitive impairment						
No	4703	86.90	5129	89.40	9832	88.21
Yes	707	13.10	607	10.60	1314	11.79
Covariates						
Age						
50–64 years	3133	57.91	3305	57.62	6438	57.76
65 years and over	2277	42.09	2431	42.38	4708	42.24
Sex						
Male	2518	46.54	2698	47.04	5216	46.80
Female	2892	53.46	3038	52.96	5930	53.20
Marital status						
Unpartnered	1921	35.51	2052	35.77	3973	35.65
partnered	3489	64.49	3684	64.23	7173	64.35
Highest level of education						
Year 12 and below	2407	44.49	2340	40.79	4747	42.59
Professional qualifications	1782	32.94	1998	34.83	3780	33.91
University qualifications	1221	22.57	1398	24.37	2619	23.50
Annual household disposable income						
Quintile 1 (poorest)	1082	20.00	1148	20.00	2230	20.01
Quintile 2	1082	20.00	1147	20.00	2229	20.00
Quintile 3	1083	20.02	1147	20.00	2230	20.01
Quintile 4	1082	20.00	1147	20.00	2228	19.99
Quintile 5 (richest)	1081	19.98	1147	20.00	2229	20.00
Participation in labour force						
Employed	2504	46.28	2693	46.95	5197	46.63
Unemployed or not in the labour force	2906	53.72	3043	53.05	5949	53.37
Indigenous origin						
Not of Indigenous origin	5310	98.15	5622	98.01	10,932	98.08
Aboriginal or Torres Strait Islander or both	100	1.85	114	1.99	214	1.92
Geographic residency						
Major city	3476	64.25	3628	63.25	7104	63.74
Regional city/remote area	1934	35.75	2108	36.75	4042	36.26

(*continued on next page*)

Table 1 (*continued*)

Characteristics	Baseline Wave (2012) n	Baseline Wave (2012) mean/%	Final Wave (2016) n	Final Wave (2016) mean/%	Pooled in all Waves (2012–2016) n	Pooled in all Waves (2012–2016) mean/%
Smoking habits						
Non-smoker	4728	87.39	5019	87.50	9747	87.45
Currently smoking	682	12.61	717	12.50	1399	12.55
Alcohol drinking						
Non-drinker	1019	18.84	1094	19.07	2113	18.96
Active drinker	4391	81.16	4642	80.93	9033	81.04
Physical activity						
Less than the recommended level	3634	67.17	3886	67.75	7520	67.47
Recommended level	1776	32.83	1850	32.25	3626	32.53
Body Mass Index (BMI)						
Underweight	79	1.46	74	1.29	153	1.37
Healthy weight	1784	32.98	1802	31.42	3586	32.17
Overweight	2074	38.34	2137	37.26	4211	37.78
Obesity	1473	27.23	1723	30.04	3196	28.67
Disability status						
No	3069	56.73	3361	58.59	6430	57.69
Yes	2341	43.27	2375	41.41	4716	42.31

assessed health, and health satisfaction.

Table 3 presents the average marginal effects of self-assessed health and health satisfaction associated with cognitive impairment, based on the regression results from Models 3 and 4 in Table 2. It is observed that the average marginal effects were positive for the lower categories but negative for the higher categories. The findings indicate that individuals with cognitive impairment were 5.79 percentage points and 2.04 percentage points less likely to fall into the fourth and fifth categories of self-assessed health, respectively, compared to those without cognitive impairment. Similarly, the likelihood of individuals with cognitive impairment experiencing health satisfaction in the eighth, ninth, and tenth categories is reduced by 0.88, 1.11, and 0.59 percentage points, respectively, compared to those without cognitive impairment.

3.1. Robustness check

Table 4 shows the sensitivity analysis, which evaluates the robustness of the pooled findings (Models 1, 2, 3, and 4). The models initially reported in Table 2 were reassessed using the generalised estimating equation (GEE) approach and the random-effects generalised least squares (GLS) technique. The findings of the sensitivity analysis closely matched the baseline values for all the factors of interest. For example, the results from models 1, 2, 3 and 4 in Table 4 showed that participants with cognitive impairment had significantly lower general health ($\beta = -3.55$, SE = 0.56), mental health ($\beta = -3.89$, SE = −7.74), self-assessed health ($\beta = -0.19$, SE = 0.02), and health satisfaction ($\beta = -0.14$, SE = 0.06), respectively, compared to those without cognitive impairment.

3.2. Heterogenous effects

Tables 5, 6, 7, and 8 showed the results of adjusted random-effects GLS and ordered logistic regression models designed to investigate if the results obtained on the relationship between cognitive impairment and various health outcomes (general health, mental health, self-assessed health, and health satisfaction) vary by age and gender. Across both age groups (50–64 years and 65 years and over), individuals

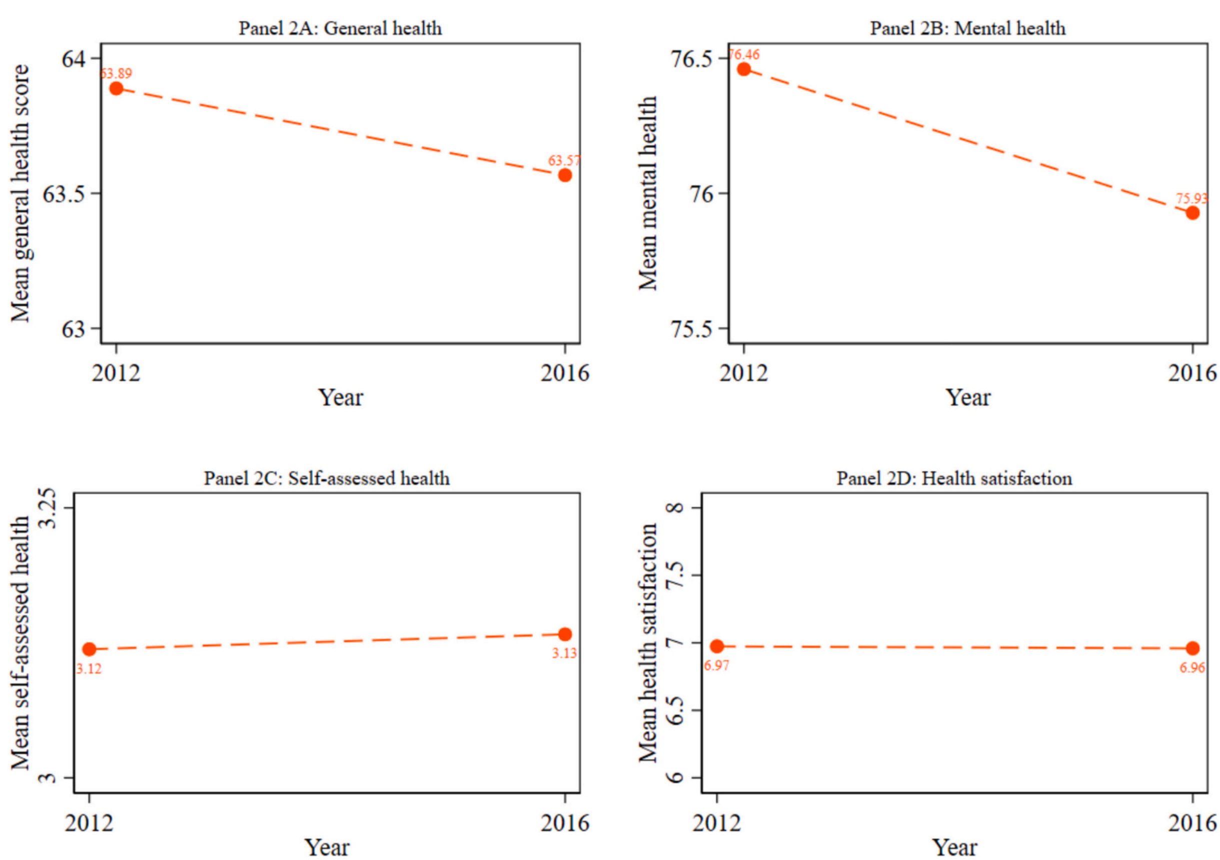

Fig. 2. Distribution of four types of health outcomes (general health, mental health, self-assessed health, and health satisfaction) in older Australians, 2012–2016.

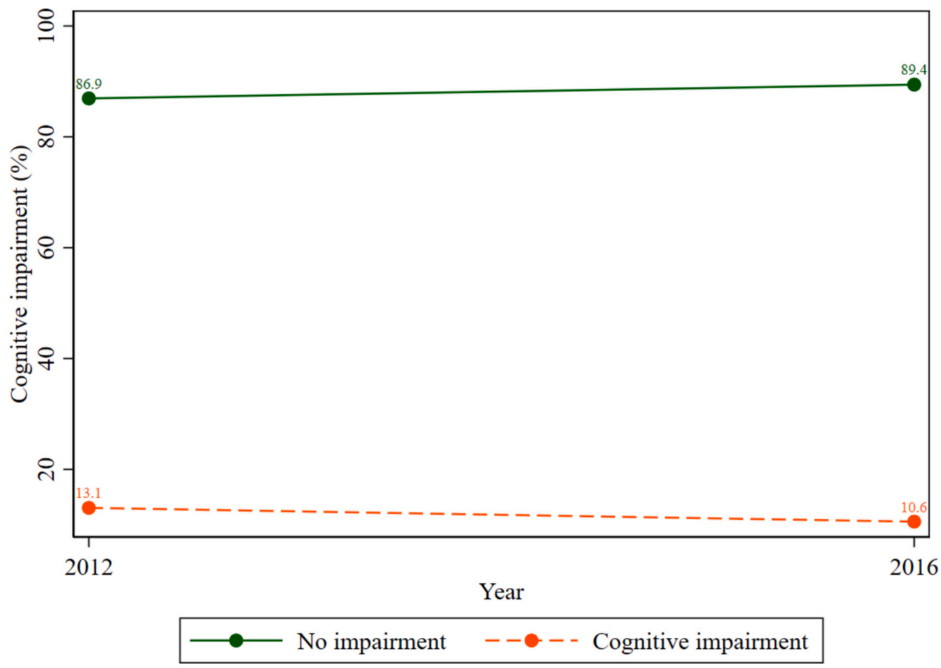

Fig. 3. Rate of cognitive impairment among older Australians, 2012–2016.

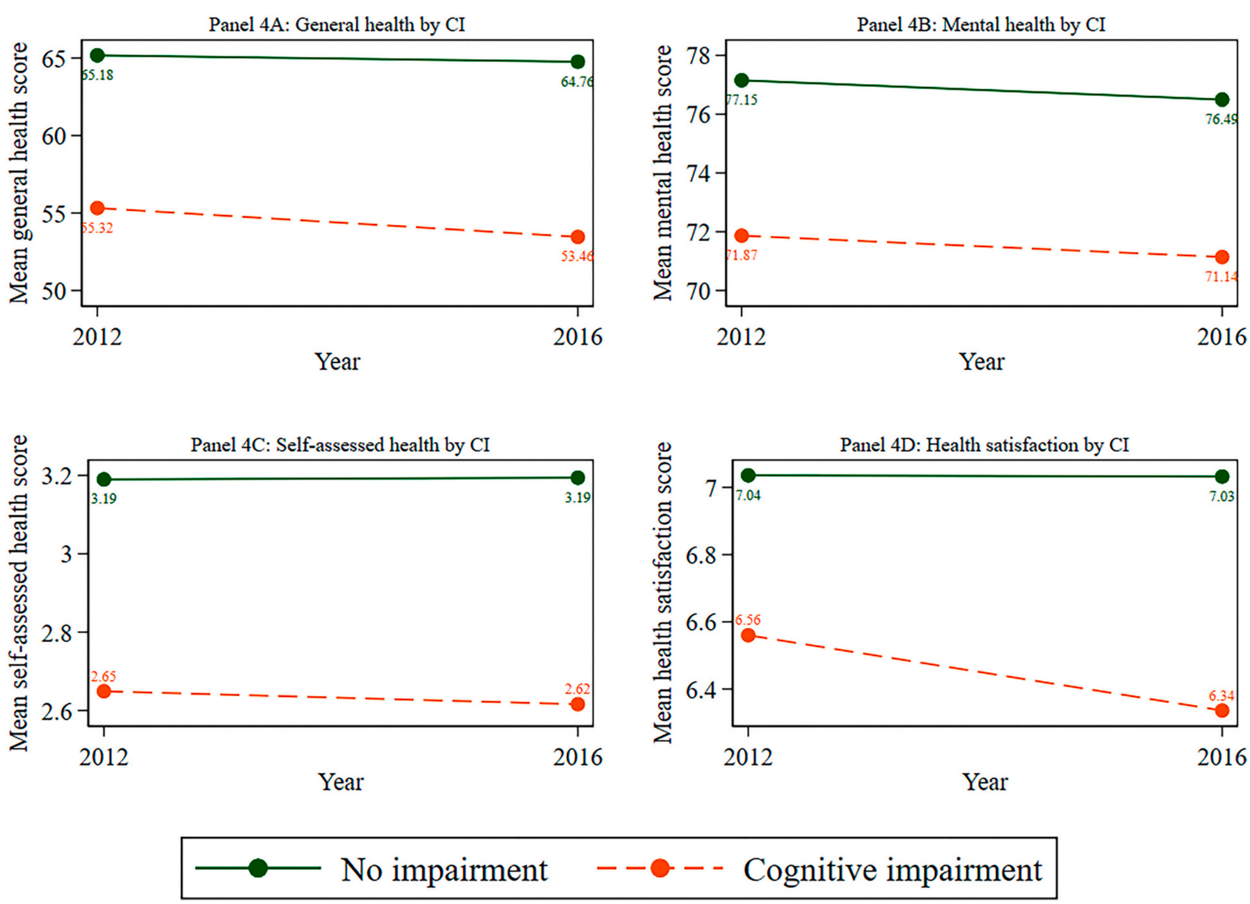

Fig. 4. Mean health outcomes (general health, mental health, self-assessed health, and health satisfaction) by status of cognitive impairment.

with cognitive impairment reported poorer mental health (Table 6), self-assessed health (Table 7) and health satisfaction (Table 8) compared to those without cognitive impairment which is in line with the main regression results. For example, Model 2 of Tables 6, 7, and 8 demonstrate that participants aged 65 years and older with cognitive impairment had significantly lower scores in mental health ($\beta = -3.92$, SE =

Table 2
The relationship between cognitive impairment and four different types of health outcomes (general health, mental health, self-assessed health, and health satisfaction).

Variables	Model 1	Model 2	Model 3	Model 4
	Random-effects GLS	Random-effects GLS	Random-effects Ordered logistic regression	Random-effects Ordered logistic regression
	General health	Mental health	Self-assessed health	Health satisfaction
	β (SE)	β (SE)	β (SE)	β (SE)
Exposure variable				
Cognitive impairment				
No (ref)				
Yes	−2.82*** [0.56]	−2.93*** [0.53]	−0.75*** [0.10]	−0.19* [0.09]
Covariates				
Age				
50–64 years (ref)				
65 years and over	1.97*** [0.42]	5.15*** [0.39]	0.15* [0.08]	0.86*** [0.07]
Sex				
Male (ref)				
Female	2.90*** [0.42]	−0.60 [0.38]	0.35*** [0.07]	0.24*** [0.06]
Marital status				
Unpartnered (ref)				
partnered	0.80* [0.41]	1.81*** [0.38]	0.13 [0.07]	0.22*** [0.06]
Highest level of education				
Year 12 and below (ref)				
Professional qualifications	1.03* [0.48]	0.23 [0.44]	0.22** [0.08]	−0.03 [0.07]
University qualifications	0.55 [0.55]	0.43 [0.48]	0.58*** [0.10]	−0.12 [0.08]
Annual household disposable income				
Quintile 1 (poorest)	−2.74*** [0.57]	−2.36*** [0.53]	−0.61*** [0.10]	−0.45*** [0.09]
Quintile 2	−3.06*** [0.52]	−1.49*** [0.48]	−0.55*** [0.10]	−0.45*** [0.08]
Quintile 3	−1.82*** [0.48]	−0.89* [0.44]	−0.29*** [0.09]	−0.20** [0.08]
Quintile 4	−0.77 [0.44]	−0.08 [0.41]	−0.20* [0.08]	−0.14* [0.07]
Quintile 5 (richest) (ref)				
Participation in labour force				
Employed (ref)				
Unemployed or not in the labour force	−4.51*** [0.43]	−2.31*** [0.40]	−0.70*** [0.08]	−0.40*** [0.07]
Indigenous origin				
Not of Indigenous origin(ref)				
Aboriginal or Torres Strait Islander or both	−2.38 [1.57]	−0.05 [1.42]	−0.25 [0.26]	0.09 [0.24]
Geographic residency				
Major city (ref)				
Regional city/ remote area	−0.01 [0.41]	0.28 [0.37]	−0.16* [0.07]	0.04 [0.06]
Smoking habits				
Non-smoker (ref)				
Currently smoking	−4.06*** [0.57]	−3.33*** [0.57]	−0.88*** [0.1]	−0.52*** [0.09]
Alcohol drinking				
Non-drinker (ref)				
Active drinker	3.14*** [0.51]	1.89*** [0.46]	0.58*** [0.08]	0.23*** [0.07]
Physical activity				
Less than the recommended level (ref)				
Recommended level	5.78*** [0.34]	3.73*** [0.30]	1.01*** [0.07]	0.83*** [0.06]
Body Mass Index (BMI)				
Underweight	−5.16*** [1.51]	−4.14** [1.48]	−0.80*** [0.25]	−0.50 [0.27]
Healthy weight (ref)				
Overweight	−1.45*** [0.4]	−0.48 [0.36]	−0.22*** [0.07]	−0.23*** [0.06]
Obesity	−5.70*** [0.49]	−1.28*** [0.43]	−1.07*** [0.09]	−0.89*** [0.07]
Disability status				
No (ref)				
Yes	−14.03*** [0.40]	−5.34*** [0.33]	−2.39*** [0.07]	−2.37*** [0.06]

Notes: 1. Values are rounded off to two decimal places. 2. Ref means reference category. 3. Robust standard errors are in brackets.
4. ***, **, and * denote significance at the $p < 0.001$, $p < 0.01$, and $p < 0.05$ levels, respectively.

0.60), self-assessed health (β = −0.92, SE = 0.12), and health satisfaction (β = −0.21, SE = 0.10), respectively, compared to their counterparts aged 65 years and older without cognitive impairment. However, the study revealed a complex interplay between gender and cognitive impairment on various health outcomes. While females with cognitive impairment consistently reported poorer health outcomes across all four domains: general health (Model 4, Table 5), mental health (Model 4, Table 6), self-assessed health (Model 4, Table 7) and health satisfaction (Model 4, Table 8), the results for males were more nuanced. For males, the association between cognitive impairment and health satisfaction

Table 3
Relevant marginal effects results obtained from random-effects ordered logistic regressions.

Overall well-being score	Self-assessed health	Health satisfaction
	Variable of interest-cognitive impairment	
	Marginal effect, *P* value	Marginal effect, P value
0		0.0009; 0.05
1	0.0208; <0.001	0.0013; 0.05
2	0.0494; <0.001	0.0023; 0.04
3	0.0081; <0.001	0.0036; 0.04
4	−0.0579; <0.001	0.0037; 0.04
5	−0.0204; <0.001	0.0063; 0.04
6		0.0047; 0.03
7		0.0029; 0.02
8		−0.0088; 0.04
9		−0.0111; 0.03
10		−0.0059; 0.03

(Model 3, Table 8) was not statistically significant, but a clear inverse association was observed for general health (Model 3, Table 5), mental health (Model 3, Table 6), and self-assessed health (Model 3, Table 7), meaning those with cognitive impairment reported poorer health outcomes. For example, Model 3 of Tables 5, 6, and 7 reveals that male participants with cognitive impairment scored significantly lower in general health (β = −1.88, SE = 0.79), mental health (β = −2.94, SE = 0.77), and self-assessed health (β = −0.62, SE = 0.14), respectively, compared to their male counterparts without cognitive impairment.

Table 9 summarizes the group comparison of interaction effects between cognitive impairment, annual household disposable income, and disability status on four health outcomes: general health, mental health, self-assessed health, and health satisfaction. The results showed that individuals with cognitive impairment and from the lowest household disposable income quintile (quintile 1) had significantly lower scores across all four health outcomes compared to those without cognitive impairment and from the highest disposable income quintile (quintile 5). For instance, those with cognitive impairment and from the lowest disposable income quintile (quintile 1) exhibited significantly lower general health (β = −0.88, SE = 0.15) [model 1], mental health (β = −0.93, SE = 0.16) [model 2], self-assessed health (β = −1.26, SE = 0.16) [model 3], and health satisfaction (β = −0.51, SE = 0.15) [model 4] scores compared to their counterparts. Similarly, individuals with both cognitive impairment and a disability demonstrated markedly lower scores in general health, mental health, self-assessed health, and health satisfaction compared to those without cognitive impairment and no disability. For example, participants with cognitive impairment and a disability showed significantly lower mental health (β = −1.57, SE = 0.12) [model 6], self-assessed health (β = −3.16, SE = 0.13) [model 7], and health satisfaction (β = −2.57, SE = 0.12) [model 8] relative to their counterparts without cognitive impairment and no disability.

4. Discussion

This study investigated the relationship between four health outcomes (general health, mental health, self-assessed health, and health satisfaction) and cognitive impairment among older Australians using nationally representative longitudinal data. The initial hypothesis posited a negative association between cognitive impairment and various health outcomes. The findings indicated that people with cognitive impairment had significantly lower general health, mental health, self-assessed health, and health satisfaction compared to those without cognitive impairment. Furthermore, the study findings unveiled the average marginal effects of health satisfaction and self-assessed health concerning cognitive impairment. The findings indicated that cognitive impairment reduces the likelihood of transitioning into the highest category in both self-assessed health and health satisfaction, provided all other variables remain constant. In addition, heterogeneous effects revealed that individuals with cognitive impairment, regardless of age group (50–64 years or 65 years and older), reported poorer mental health, self-assessed health, and health satisfaction compared to those without cognitive impairment. Furthermore, females with cognitive impairment consistently reported poorer health outcomes across all four domains—general health, mental health, self-assessed health, and

Table 5
Heterogenous Effect: the relationship between cognitive impairment and general health by age and gender.

Variables	Model 1	Model 2	Model 3	Model 4
	Random-effects GLS	Random-effects GLS	Random-effects GLS	Random-effects GLS
	General health (Age 50–64 years)	General health (Age 65 years and over)	General health (Male)	General health (Female)
	β (SE)	β (SE)	β (SE)	β (SE)
Exposure variable				
Cognitive impairment				
No (ref)				
Yes	−1.59 [1.04]	−3.90 [0.68]	−1.88* [0.79]	−3.61*** [0.81]

Notes: 1. The results of the robustness check are only shown for the cognitive impairment for brevity 2. Values in brackets are robust standard errors. 3. All the models were adjusted for age, sex, marital status, highest level of education, annual household disposable income, participation in labour force, indigenous origin, geographic residency, smoking habits, Alcohol drinking, physical activity, body Mass Index, and disability status. 4. Ref means reference category. 5. The detailed results can be observed in Table A2 in the appendix of the online supplementary material. 6. ***, and * denote significance at the p < 0.001 and p < 0.05 levels, respectively.

Table 4
The relationship between cognitive impairment and four different types of health outcomes (general health, mental health, self-assessed health, and health satisfaction).

	Model 1	Model 2	Model 3	Model 4
	Generalised estimating equation	Generalised estimating equation	Random-effects GLS	Random-effects GLS
	General health	Mental health	Self-assessed health	Health satisfaction
	β (SE)	β (SE)	β (SE)	β (SE)
Exposure variable				
Cognitive impairment				
No (ref)				
Yes	−3.55*** [0.56]	−3.89*** [−7.74]	−0.19*** [0.02]	−0.14* [0.06]

Notes: 1. The results of the robustness check are only shown for the cognitive impairment for brevity 2. Values in brackets are robust standard errors. 3. All the models were adjusted for age, sex, marital status, highest level of education, annual household disposable income, participation in labour force, indigenous origin, geographic residency, smoking habits, Alcohol drinking, physical activity, body Mass Index, and disability status. 4. Ref means reference category. 5. The detailed results can be observed in Table A1 in the appendix of the online supplementary material. 6. *** and * denote significance at the $p < 0.001$ and $p < 0.05$ levels, respectively.

Table 6
Heterogenous Effect: the relationship between cognitive impairment and mental health by age and gender.

Variables	Model 1	Model 2	Model 3	Model 4
	Random-effects GLS	Random-effects GLS	Random-effects GLS	Random-effects GLS
	Mental health (Age 50–64 years)	Mental health (Age 65 years and over)	Mental health (Male)	Mental health (Female)
	β (SE)	β (SE)	β (SE)	β (SE)
Exposure variable				
Cognitive impairment				
No (ref)				
Yes	−2.33* [1.05]	−3.92*** [0.60]	−2.94*** [0.77]	−2.88*** [0.72]

Notes: 1. The results of the robustness check are only shown for the cognitive impairment for brevity 2. Values in brackets are robust standard errors. 3. All the models were adjusted for age, sex, marital status, highest level of education, annual household disposable income, participation in labour force, indigenous origin, geographic residency, smoking habits, Alcohol drinking, physical activity, body Mass Index, and disability status. 4. Ref means reference category. 5. The detailed results can be observed in Table A3 in the appendix of the online supplementary material. 6. ***, and * denote significance at the $p < 0.001$ and $p < 0.05$ levels, respectively.

Table 7
The relationship between cognitive impairment and self-assessed health by age and gender.

Variables	Model 1	Model 2	Model 3	Model 4
	Ordered logit	Ordered logit	Ordered logit	Ordered logit
	Self-assessed health (Age 50–64 years)	Self-assessed health (Age 65 years and over)	Self-assessed health (Male)	Self-assessed health (Female)
	β (SE)	β (SE)	β (SE)	β (SE)
Exposure variable				
Cognitive impairment				
No (ref)				
Yes	−0.55*** [0.19]	−0.92*** [0.12]	−0.62*** [0.14]	−0.85*** [0.14]

Notes: 1. The results of the robustness check are only shown for the cognitive impairment for brevity 2. Values in brackets are robust standard errors. 3. All the models were adjusted for age, sex, marital status, highest level of education, annual household disposable income, participation in labour force, indigenous origin, geographic residency, smoking habits, Alcohol drinking, physical activity, body Mass Index, and disability status. 4. Ref means reference category. 5. The detailed results can be observed in Table A4 in the appendix of the online supplementary material. 6. *** denote significance at the $p < 0.001$ level.

Table 8
The relationship between cognitive impairment and health satisfaction by age and gender.

Variables	Model 1	Model 2	Model 3	Model 4
	Ordered logit	Ordered logit	Ordered logit	Ordered logit
	Health satisfaction (Age 50–64 years)	Health satisfaction (Age 65 years and over)	Health satisfaction (Male)	Health satisfaction (Female)
	β (SE)	β (SE)	β (SE)	β (SE)
Exposure variable				
Cognitive impairment				
No (ref)				
Yes	−0.42* [0.17]	−0.21* [0.10]	−0.12 [0.13]	−0.24* [0.13]

Notes: 1. The results of the robustness check are only shown for the cognitive impairment for brevity 2. Values in brackets are robust standard errors. 3. All the models were adjusted for age, sex, marital status, highest level of education, annual household disposable income, participation in labour force, indigenous origin, geographic residency, smoking habits, Alcohol drinking, physical activity, body Mass Index, and disability status. 4. Ref means reference category. 5. The detailed results can be observed in Table A5 in the appendix of the online supplementary material. 6. * denote significance at the $p < 0.05$ levels.

health satisfaction. Similarly, male participants with cognitive impairment reported poorer health outcomes in general health, mental health, and self-assessed health; however, no significant association was observed for health satisfaction. The study finally examined the group comparison of interaction effects between cognitive impairment, household disposable income, and disability status with four distinct health outcomes: general health, mental health, self-assessed health, and health satisfaction. The results showed that individuals with cognitive impairment and from the lowest household disposable income quintile had significantly poorer scores across all health outcomes compared to those without cognitive impairment and from the highest household disposable income quintile. Similarly, individuals with both cognitive impairment and a disability had markedly lower scores across all four health outcomes compared to those without cognitive impairment and disability.

4.1. *Cognitive impairment and general health*

This study revealed that participants with cognitive impairment tended to have poorer self-reported general health compared to those without cognitive impairment. This finding aligns with the existing body of research, in which there exists an association between mild and non-dementing cognitive impairment and poorer health at the population level (Frisoni et al., 2000). Furthermore, numerous studies have substantiated the longitudinal association between cognitive function and physical performance in older adults, with cognitive assessments being regarded as predictors of the decline in physical performance, including activities of daily living and instrumental activities of daily living (Atkinson et al., 2007; Tabbarah et al., 2002; Wang et al., 2002). The inverse relationship between cognitive impairment and general health, which manifests as difficulties with performing daily tasks and working because of health issues, could be explained as follows: physical performance may necessitate more cognitive monitoring as people get

Table 9

Abridged regression results of group comparison of the interaction effect between cognitive impairment, household disposable income, and disability status on four different types of health outcomes (general health, mental health, self-assessed health, and health satisfaction).

Models	Model 1	Model 2	Model 3	Model 4
Variables	General Health	Mental Health	Self-assessed Health	Health Satisfaction
	Random-effects ordered logistic regression	Random-effects ordered logistic regression	Random-effects ordered logistic regression	Random-effects ordered logistic regression
Group comparison in the interaction effect between cognitive impairment and household disposable income				
No impairment # Quintile 1	−0.46*** [0.10]	−0.39*** [0.10]	−0.65*** [0.11]	−0.50***[0.10]
No impairment # Quintile 2	−0.51*** [0.09]	−0.26***[0.09]	−0.56*** [0.10]	−0.47***[0.09]
No impairment # Quintile 3	−0.29*** [0.08]	−0.15 [0.08]	−0.29*** [0.09]	−0.19** [0.08]
No impairment # Quintile 5	−0.14 [0.08]	0.01 [0.08]	−0.20** [0.09]	−0.13 [0.07]
No impairment # Quintile 5 (ref)	1	1	1	1
Cognitive impairment # Quintile 1	−0.88*** [0.15]	−0.93*** [0.16]	−1.26*** [0.16]	−0.51*** [0.15]
Cognitive impairment # Quintile 2	−0.89*** [0.17]	−0.87*** [0.17]	−1.33*** [0.18]	−0.63*** [0.17]
Cognitive impairment # Quintile 3	−0.82*** [0.19]	−0.57*** [0.21]	−1.15*** [0.21]	−0.59*** [0.18]
Cognitive impairment # Quintile 4	−0.74** [0.31]	−0.65* [0.33]	−1.07*** [0.28]	−0.64* [0.29]
Cognitive impairment # Quintile 5	−0.30 [0.33]	−0.52 [0.29]	−0.94*** [0.35]	−0.36 [0.28]

Model	Model 5	Model 6	Model 7	Model 8
Group comparison in the interaction effect between cognitive impairment and disability status				
No impairment # no disability (ref)	1	1	1	1
No impairment # disability	−2.29*** [0.07]	−0.96*** [0.06]	−2.37*** [0.07]	−2.37*** [0.06]
Cognitive impairment # no disability	−0.36* [0.14]	−0.43*** [0.15]	−0.67*** [0.19]	−0.18 [0.14]
Cognitive impairment # disability	−2.78 [0.12]	−1.57*** [0.12]	−3.16*** [0.13]	−2.57*** [0.12]

Notes: 1. The results only show the interaction effect for brevity 2. Values in brackets are robust standard errors. 3. All the models were adjusted for age, sex, marital status, highest level of education, participation in the labour force, Indigenous origin, geographic residency, smoking habits, Alcohol drinking, physical activity, and body Mass Index. 4. Ref means reference category. 5. ***, **, and * denote significance at the $p < 0.001$, $p < 0.01$, and $p < 0.05$ levels, respectively.

older, and when cognitive function deteriorates, the capacity to track physical performance may also decline (Atkinson et al., 2010). Besides, older adults were more vulnerable to comorbid chronic conditions, which caused them to judge their health less positively.

4.2. Cognitive impairment and mental health

The findings provided evidence that participants with cognitive impairment exhibited poorer mental health compared to those without cognitive impairment. A recent Australian study revealed that people with cognitive impairment tended to have a lower HRQoL where older Australians with cognitive impairment had lower mental component summary (MCS) scores compared to those without cognitive impairment (Keramat et al., 2023). Another study found that cognitive deficits have an impact on the ability of individuals with mental illness to accomplish daily tasks, both when they are experiencing acute symptoms and when they are in periods of remission (Clements et al., 2015). Depression, anxiety, and loneliness are possible channels through which cognitive impairment might affect mental health. For example, it was found that cognitive impairment increased the likelihood of experiencing depression and anxiety (Yates et al., 2013), and participants with mild cognitive impairment were more likely to experience symptoms of minor depression, such as feeling low on energy, sluggish, and worse in the mornings (Kumar et al., 2006). Additionally, cognitive decline has been identified as a predictor for self-reported loneliness (Boss et al., 2015; Burholt et al., 2017) which may be detrimental to mental health.

4.3. Cognitive impairment and self-assessed health

This study observed a substantial decrease in self-assessed health among those with cognitive impairment compared to those without cognitive impairment. This result aligns with previous research suggesting a link between lower cognitive function and poorer self-reported health (Kim, 2021). The inverse association between cognitive impairment and poor self-assessed health can be attributed to the fact that cognitive impairment increases the probability of disability in older individuals (Di Carlo et al., 2000; Whitson et al., 2014), and adults with disability tended to report lower self-rated health (Carlson et al., 2013).

4.4. Cognitive impairment and health satisfaction

This study also examined the association between cognitive impairment and health satisfaction. The results showed that people with cognitive impairment had lower levels of health satisfaction than those without cognitive impairment. A prior study provided compelling evidence of an association between moderate and severe cognitive impairment and a decrease in HRQoL. More specifically, a decrease in physical component summary score (PCS) score (Keramat et al., 2023). Poor health satisfaction among people with cognitive impairment can be ascribed to decreased levels of health satisfaction. A recent study found individuals with cognitive disorders, such as autism, attention deficit, and memory loss, exhibit lower levels of satisfaction with their health compared to the general population (Stone et al., 2023). Cognitive impairment is frequently underdiagnosed in hospital settings, and even when found, patients may still face adverse health outcomes due to disparities in care. These disparities might manifest as health-related symptoms being disregarded because of the patient's impairment, or negative attitudes from healthcare staff (Australian Commission on Safety and Quality in Health Care, 2019).

4.5. Implications for policy and practice

Efforts to tackle health inequalities should focus on attaining fairness in health and health outcomes, rather than just equal allocation of resources in the healthcare system (Whitehead, 1990). The findings indicate that disability prevention strategies for older adults with cognitive impairment should include evaluating the health outcomes of their care and integrating this assessment into their care and support plans. Early detection of cognitive decline might enhance older adults' satisfaction with their health and potentially prevent them from being disabled in the future. The Australian Commission on Safety and Quality in Health Care has developed numerous resources to support the safety and quality improvement systems in Australian health care, including eight National Safety and Quality Health Service (NSQHS) standards, which are a national statement on the type and quality of care that all patients should receive (Australian Commission on Safety and Quality in Health Care, 2023). The standards encompass a wide range of acts that pertain to the provision and enhancement of care for individuals with cognitive impairment. Hospitals need to establish a protocol to identify and provide care for individuals who have or are at risk of cognitive impairment, promptly detect sudden worsening in mental state, and effectively regulate the administration of psychoactive medications (Australian Commission on Safety and Quality in Health Care, 2019). This study proposes that standard healthcare prevention, targeted intervention, and treatment procedures should prioritize older adults with cognitive impairment and other forms of disability. To best address this challenge, a coordinated approach involving clinicians, researchers who can guide interventions, and government support for funding and policy changes is required.

4.6. Strengths, limitations, and avenues for further research

One of the main strengths of this study is the utilization of an extensive population-based longitudinal design with a diverse range of older age cohorts. This is one of the first studies in Australia that examine the relationship between cognitive impairment and four distinct health outcomes using a nationally representative dataset. In addition, to prevent spurious associations, the study incorporated numerous confounding variables, including health-related behavioural characteristics (e.g., smoking habits, alcohol consumption, and levels of physical activity). Moreover, this study employed a longitudinal random-effects regression model to examine the between-person variations in the relationships between self-perceived health outcomes and cognitive impairment among older adults. Furthermore, we have provided evidence that cognitive impairment tests, specifically the SDMT and BDS, have been a validated tool to measure cognitive impairment.

The study has several limitations that warrant mention. Firstly, the reliance on self-reported data for health outcomes, including general health, mental health, self-assessed health, and health satisfaction, inherently introduces potential biases that may influence the validity of our findings. Social desirability bias, where individuals may overstate their health to conform to societal expectations or avoid stigma, is a significant concern, particularly for subjective assessments like mental health and self-assessed health. Recall bias, especially among older adults and those with cognitive impairments, can also distort the accuracy of reported health experiences. These biases may lead to either under- or overestimation of the true association between cognitive impairment and health outcomes. To mitigate these risks, we utilized validated self-report measures with established reliability and validity. Furthermore, statistical adjustments were made to account for potential confounders, including age, gender, socioeconomic status, and coexisting health conditions. Despite the inherent limitations of self-reported data, its feasibility for collecting data from large populations makes it a widely used and practical method in population-based research (Haque et al., 2024a; Haque et al., 2024b). Secondly, the lack of universally agreed-upon cut-off scores for the SDMT and BDS scales poses a limitation in accurately defining and encompassing the full spectrum of cognitive impairment. While these tests provide valuable insights into core cognitive processes, they may not fully capture the memory deficits commonly associated with cognitive impairment or dementia. This could have led to an underestimation of the prevalence of cognitive impairment in this sample. Employing memory-focused assessments, such as the Montreal Cognitive Assessment, Mini-Mental State Examination, or Saint Louis University Mental Status test, might have offered a more targeted approach and enhanced comparability with existing literature. Thirdly, while our findings suggest an association between cognitive impairment and health outcomes, it is important to acknowledge that this study cannot establish a definitive causal relationship. The observational nature of this study limits our ability to establish definitive causal relationships. Finally, the potential of reverse causality, where poorer health may contribute to cognitive decline, cannot be ruled out. Future research employing experimental or quasi-experimental designs could provide greater clarity on the causal pathways underlying these associations.

This study highlights the significant association between cognitive impairment and poor health outcomes among older Australians, pointing to several areas for further investigation. Future studies should explore the mechanisms underlying these associations, such as the role of social determinants, healthcare access, and lifestyle factors in mediating or moderating the relationship between cognitive impairment and health outcomes. Rigorous evaluations of innovative interventions, such as cognitive stimulation therapy, music therapy, and technology-assisted therapy, are needed to identify strategies for improving health outcomes in individuals with cognitive impairment. Such research could inform the development and implementation of effective and cost-efficient interventions within the Australian healthcare system. By expanding the scope of research to incorporate diverse measures of cognitive impairment, particularly those addressing memory deficits (e.g., Montreal Cognitive Assessment or Mini-Mental State Examination), it would be possible to enhance comparability with international studies and provide deeper insights into cognitive health. Additionally, investigating the impact of early interventions, such as physical activity, mental stimulation, or social engagement programs, could yield actionable recommendations for policymakers. Studies with longer follow-up periods and additional waves of the HILDA Survey would offer a more comprehensive understanding of the progression of cognitive impairment and its cumulative effects on health outcomes. Finally, qualitative research capturing the lived experiences of individuals with cognitive impairment and their caregivers could complement quantitative findings, providing a holistic perspective on the challenges faced and potential strategies to enhance their well-being.

5. Conclusions

This paper examined the association between cognitive impairment and four distinct health outcomes among older adults using a nationally representative sample. The findings of our research fill an essential gap in the current body of literature since earlier studies on this topic were limited in scope. The findings suggest a significant association between cognitive impairment and reduced well-being across multiple dimensions. The identified association indicate that cognitive decline presents a significant risk not only to mental health but also to physical and perceived well-being. This holistic understanding underscores the necessity of reviewing and incorporating cognitive assessment into standard clinical protocols for adults, especially in older individuals.

This research underscores the importance of healthcare practitioners prioritizing cognitive assessments during routine patient consultations, particularly for older adults. By incorporating cognitive testing into standard care, healthcare providers can support primary prevention efforts and improve health outcomes for individuals with cognitive decline. Specifically, we recommend including cognitive screening as part of regular health check-ups for older adults, especially those aged 50 years and above, using validated tools such as the Montreal Cognitive Assessment (MoCA) or Mini-Mental State Examination (MMSE). Additionally, clinical pathways should be established to facilitate early intervention in the event of a diagnosis of cognitive impairment diagnosis, with referrals to multidisciplinary specialists such as occupational therapists, dietitians, and mental health counsellors. To maintain the currency of clinical practice, we recommend the regular update of clinical recommendations informed by growing scientific and clinical evidence, as well as findings from longitudinal research and randomised controlled trials.

Moving forward, further research is essential to explore the mechanisms linking cognitive impairment to various health outcomes. Recognising modifiable risk factors that could inform preventive strategies will be crucial in mitigating the impact of cognitive decline on the health and well-being of older adults.

CRediT authorship contribution statement

Rezwanul Haque: Writing – review & editing, Writing – original draft, Software, Methodology, Formal analysis, Data curation, Conceptualization. **Khorshed Alam:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Conceptualization. **Jeff Gow:** Writing – review & editing, Visualization, Validation, Supervision, Conceptualization. **Christine Neville:** Writing – review & editing, Visualization, Validation, Supervision, Conceptualization. **Syed Afroz Keramat:** Writing – review & editing, Supervision, Software, Methodology, Formal analysis, Data curation, Conceptualization.

Ethical approval and consent to participant

This study used secondary data from de-identified existing unit records from the HILDA Survey, so ethical approval was not required. However, the authors completed and signed the Confidentiality Deed Poll and sent it to NCLD (https://ncldresearch@dss.gov.au) and ADA (https://ada@anu.edu.au) before receiving approval for their data application. The datasets analysed and/or generated during the current study are subject to the signed confidentiality deed.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the author(s) used Grammarly and OpenAI in order to improve the readability and language of the manuscript. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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Declaration of competing interest

"I have nothing to declare"

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.actpsy.2025.104770.

Data availability

The data were obtained from the Melbourne Institute of Applied Economic and Social Research (https://melbourneinstitute.unimelb.edu.au/). Though the information is not openly available, appropriately qualified researchers can access the data after following their protocols and meeting their requirements. Their contact address is Melbourne Institute of Applied Economic and Social Research, the University of Melbourne, VIC 3010, Australia.

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