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Research paper

Beyond the sum of their parts: The combined association of dementia and chronic pain with self-care limitations in older Australians

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A B S T R A C T

Background: The purpose of this study was to investigate the association between dementia, chronic pain and self-care limitations. Additionally, the study sought to explore the relationship of co-occurring dementia and chronic pain with self-care limitations.

Methods: Cross-sectional data derived from the Survey of Disability, Ageing and Carers (SDAC) was used to conduct this study. The pooled association between dementia, and chronic pain, with self-care limitations was assessed using ordered logistic regression model. Furthermore, the study also examined the group comparison of interaction effects between co-occurring dementia and chronic pain with self-care limitations.

Results: The ordered logistic regression analysis indicated that people with dementia had significantly higher odds of experiencing greater self-care limitations (adjusted odds ratio [aOR]: 15.12, 95 % confidence interval [CI]: 12.50–18.29) compared to people without dementia. Similarly, chronic pain was independently associated with increased self-care limitations (aOR: 5.98, 95 % CI: 5.49–6.52) compared to people without chronic pain. Additionally, interaction effect analysis revealed that the co-occurrence of dementia and chronic pain substantially heightened the likelihood of self-care limitations (aOR: 66.54, 95 % CI: 52.27–84.69) relative to people without either condition.

Conclusions: Disability was higher among older Australians with dementia and chronic pain, and this risk can be increased if the two conditions co-exist. A continuous, aligned, and personalised healthcare approach is needed to establish self-care priorities, especially in groups of people with the greatest need.

1. Introduction

Approximately half of older Australians, aged 65 years and older, have disabilities, and 1.3 million living at home have mobility or self-care limitations and require support (Australian Bureau of Statistics, 2019). The Centre for International Economics predicts that 5.75 million Australians will have mobility issues by 2060 (Centre for International Economics, 2020). Most older adults with disabilities receive help from family or friends, and the need for formal care rises with the severity of the disability (Van Houtven et al., 2020). People who do not actively manage their health have significantly poorer health outcomes despite equality of health service access (Hibbard et al., 2009). Furthermore, activity limitations are linked to a wide range of detrimental effects, including decreased social interaction (Cudjoe et al., 2020), nursing home admission (Wolff et al., 2018), and an increased risk of mortality (Pongiglione et al., 2016).

Dementia is one of the leading causes of disability and dependency among older adults, affecting an estimated 55 million people globally (World Health Organization, 2023). In Australia, the prevalence of dementia among people aged 65 years and older rose from 5099 per 100,000 in 2015 to 5229 in 2018 (Haque et al., 2023), and the number of people with dementia is predicted to more than double by 2058, owing to the ageing population (Australian Institute of Health and Welfare, 2023). Previous research identified cognitive impairment as a predictor of declining activities of daily living (ADL) (Barberger-Gateau and Fabrigoule, 1997; McGuire et al., 2006; Pedone et al., 2005). For instance, using the World Health Organisation Disability Assessment Schedule 2.0 ratings, a Taiwanese study found that people with dementia had global activity limitations and were restricted from participating in all six key functional domains (Huang et al., 2016). Furthermore, cognitive impairment was associated with higher odds of functional decline in ADL and Instrumental Activities of Daily Living (IADL) in the USA (McGrath et al., 2020). A study conducted in Taiwan determined that on the IADL scale, medication management and shopping were the most discriminating activities between people with normal cognitive function and those with mild cognitive impairment

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(Lee et al., 2019).

An estimated 31 % of people worldwide have chronic pain (Steingrímsdóttir et al., 2017). Prior research found that chronic pain affected between 29.9 % and 36.2 % of older Australians (Henderson et al., 2013), 55.5 % of older Swiss (Jakobsson, 2010), and 69.8 % of older Germans (Bauer et al., 2016). As shown by earlier research, there is an association between pain and functional limitations (Eggermont et al., 2014; Makris et al., 2014; Stamm et al., 2016; Valderrama-Hinds et al., 2017). For instance, older people with musculoskeletal issues (such as osteoarthritis and chronic back pain) have reported difficulty performing specific ADL tasks, like completing heavy chores, bending over or kneeling, and ascending stairs without a walking stick (Stamm et al., 2016). Another study found mobility impairment, i.e., walking a quarter mile or climbing stairs, was strongly associated with limiting back pain (Makris et al., 2014). Functional constraints involving the upper and lower extremities were reported more frequently, and ADL handicaps in older adults with arthritic pain, result in being unable to raise arms above shoulder level, push or pull heavy objects, or pick up a coin (Valderrama-Hinds et al., 2017).

The co-existence of multiple diseases in one person, i.e., multimorbidity, is the most prevalent and debilitating ailment in older adults, resulting in functional decline over time (Marengoni et al., 2009). People with dementia generally suffer from multimorbidity such as diabetes, osteoporosis, falls and fractures, stroke, and heart failure (Welsh, 2019). Alzheimer's disease (AD), the most prevalent form of dementia, frequently co-occurs with chronic pain (Cao et al., 2019). Recent research revealed that dementia risk was found to be increased by chronic pain, primarily when it occurred in several different body parts (Haque et al., 2024; Harris, 2023).

It is evident from previous research that both dementia and chronic pain increased the likelihood of declining ADLs in different country settings. Nevertheless, little is known about the association between co-occurring dementia and chronic pain with self-care limitations. A few studies in the USA considered the co-existence of conditions such as vision or hearing impairment with dementia to assess the association with self-care limitations (Assi et al., 2021; Patel et al., 2020). According to their study of adults aged 65 years and older in the USA, those with dementia and self-reported visual impairment scored worse than predicted on measures of functional activity, given the individual contributions of both disorders (Patel et al., 2020). Another cross-sectional study found that adults with dementia and dual sensory (vision and hearing) impairment had additional mobility limitations and self-care restrictions (Assi et al., 2021).

To the best of our knowledge, this study represents the first Australian investigation into the association of dementia, chronic pain, and their co-occurrence, with self-care limitations in older adults. The study's findings are crucial for planning well-informed interventions to support older individuals' independence and healthy ageing.

2. Methodology

2.1. Data source and settings

This study used data collected from the Survey of Disability, Ageing and Carers (SDAC) in 2015 and 2018. The SDAC includes data to assess the prevalence of disability and the need to assist people with disabilities. It also provides a socio-economic and demographic profile of people with disabilities, older adults, and caregivers compared to the general population. In addition, the dataset contains information about people with disabilities, long-term health conditions, and elderly people. SDAC collected data from both household and care accommodations (Australian Bureau of Statistics, 2018b). The data obtained from the household component includes self-care accommodation for the retired or aged, and other private dwellings, including houses, flats, home units, garages, tents, and other structures used as private residences. On the other hand, cared accommodation includes hospitals, residential aged care, cared components of retirement villages, aged care hostels, psychiatric institutions, and other homes (such as group homes for people with disability). Multi-stage sampling techniques were used to select the sample for the survey. In 2015, the refusal rates from two household components, namely private dwellings and self-care retirement villages, were 3.7 % and 3.8 %, respectively (Australian Bureau of Statistics, 2015). From cared-accommodation components, non-responding establishments were 10.6 %. In 2018, the refusal rate for household components was 4.9 %, while cared-accommodation non-responding rate was 9.1 % (Australian Bureau of Statistics, 2018b). The data on self-care limitations, dementia, chronic pain, and other socio-demographic variables were derived predominantly from self-reported responses from the household components (Australian Institute of Health and Welfare, 2006). Alternatively, a proxy, such as a carer, may provide the information in cases where the individual of interest cannot respond. However, in the context of cared accommodation, the survey is not reliant on self-reporting but is administered by the carer obligated to document any self-care and chronic medical conditions.

2.2. Study participants

The data for this study were drawn from the 2015 and 2018 iterations of the Survey of Disability, Ageing and Carers (SDAC), a nationwide survey conducted regularly in Australia since 1981. While earlier surveys were conducted in 1988, 1993, 1998, 2003, 2009, and 2012, this analysis focuses on 2015 and 2018, as data on dementia, one of the key exposure variables, were only available for these two years.

The total number of participants in the SDAC was 74,862 in 2015 and 65,487 in 2018, resulting in a pooled dataset of 140,349 participants. Given that dementia, a primary exposure variable, predominantly affects older individuals, the study was restricted to participants aged 65 years and older. Consequently, 54,191 participants from 2015 and 45,406 from 2018 were excluded, leaving 20,671 participants in 2015 and 20,081 in 2018, with a final pooled sample of 40,752 participants.

All relevant variables for this analysis—self-care limitations, dementia, chronic pain, age, gender, geographic remoteness, country of origin, and state—had complete data. Therefore, there were no missing observations, and the final sample sizes remained at 20,671 in 2015, 20,081 in 2018, and 40,752 in the pooled dataset. The distribution of study participants across the datasets is depicted in Fig. 1.

2.3. Outcome variable

The Survey of Disability, Ageing and Carer (SDAC) collects information about a person's self-care, communication, and mobility limitations. These three factors are regarded as "core activity limitations" (Australian Bureau of Statistics, 2018a). This paper only examined self-care limitations resulting from impairments closely aligned with Activities of Daily Living (ADL), such as requiring assistance with dressing, eating, showering or bathing, toileting, and bladder or bowel control (Australian Institute of Health and Welfare, 2006). The self-care limitations variable in SDAC is self-reported and categorised as profound, severe, moderate, mild, or no limitation. The categories are defined as follows.

Profound: A person always needs help with at least one of the self-care activities.

Severe: A person sometimes needs help with at least one of the self-care activities.

Moderate: A person who struggles with at least one of self-care activities but does not need assistance.

Mild: A person who uses aids but does not have difficulties with any self-care activities.

No limitation: Not restricted in their ability to perform self-care activities.

This study reclassified the original five categories into three. Profound and severe limitations were merged as "profound or severe",

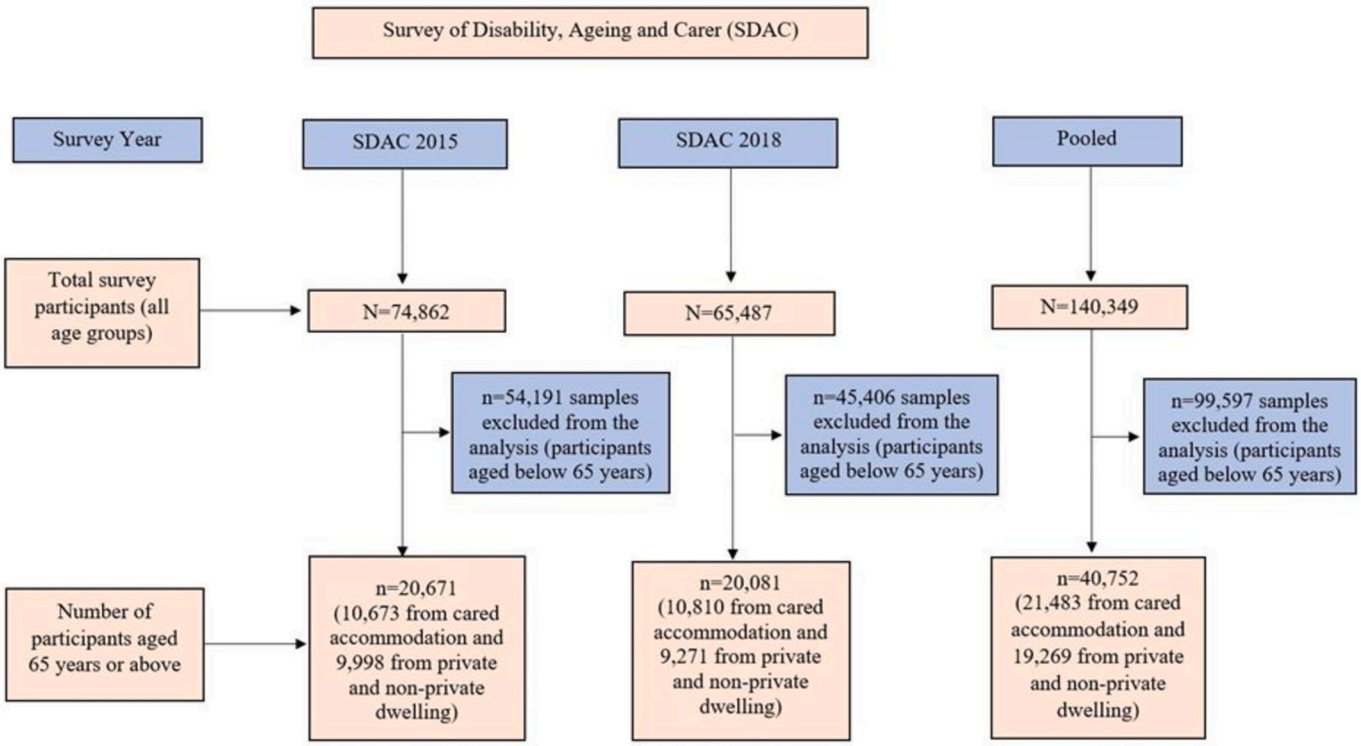

Fig. 1. Distribution of study participants and year of survey.

moderate and mild limitations became "moderate or mild," and "no self-care limitation" remained unchanged. The reclassification of self-care limitations from five categories into three was undertaken to simplify the analysis while retaining meaningful distinctions between levels of impairment. This grouping enhances interpretability by combining similar levels of functional limitations, ensuring robust comparisons across categories.

2.4. Exposure variable: dementia and chronic pain status

Data on dementia was obtained by self-reported and carer responses to the question, "Do you/persons have dementia?". However, to obtain information regarding chronic pain, the respondent was asked, "Do you experience recurring pain or discomfort?" To meet the criteria for chronic pain, the patient must have experienced recurrent pain within the past 12 months. The responses on dementia and chronic pain were coded as "yes" or "no".

2.5. Covariates

Data collection for the SDAC's cared-accommodation component was more constrained than for the household component because certain subjects were either inappropriate for proxy data collection or unrelated to those residing in cared-accommodation (Australian Bureau of Statistics, 2015). The study tried to keep the potential confounders; however, since care facilities provided much of the data on people with dementia, this study could not sustain all potential confounders to undertake a complete case analysis. Age (65–69, 70–74, 75–79, 80–84, and 85 years or more), gender (male and female), Accessibility Remoteness Index of Australia (ARIA), country of birth (Australia, English-speaking countries, non-English-speaking countries), and state were covariates included in this study. The ABS classified the Accessibility Remoteness Index of Australia (ARIA) as follows: i) "major city," ii) "inner regional area," iii) "outer regional," iv) "remote," and v) "extremely distant" (Australian Bureau of Statistics, 2016). In this study, due to the small number of individuals in each group, individuals from "outer regional," "remote," and "very remote" areas in the SDAC dataset were grouped together as "outer regional or remote area."

2.6. Estimation strategy

The characteristics of the cohorts were first summarised using descriptive statistics in the form of frequency (n) and weighted percentage (%) with 95 % confidence intervals (CI). Due to the complex survey design, additional adjustments, such as weighting, were necessary to generate correct variance estimates. The ABS has calculated a population weight for the data set; this weight was applied to the data for this analysis as it provides a broader population perspective of any result obtained. In this study, the variables 'person weight' and 'household identifier' were used for weighting. Full details on the SDAC study, including sampling and population weighting, can be found elsewhere (Australian Bureau of Statistics, 2018b). The STATA command "svy set" was utilised in the analysis to manage the intricate survey design. To evaluate the bivariate relationship between the outcome variable with dementia, chronic pain, and other variables, chi-square tests or *t*-tests have been performed.

The outcome variable, self-care limitations, was measured on an ordinal scale and categorised into three levels: "0 = No self-care limitation," "1 = Mild or moderate self-care limitation," and "2 = Profound or severe self-care limitation," with higher values indicating greater self-care limitations. Consequently, we employed an ordered logistic regression model to examine the association between dementia, and chronic pain with self-care limitations. Additionally, we conducted a group comparison to analyse the interaction effect of co-occurring dementia and chronic pain on self-care limitations. The results of the adjusted ordered logistic regression model were presented as adjusted odds ratio (aOR) and were considered statistically significant at a *p*-value of 0.05. Stata 16 (StataCorp LLC., College station, Texas) was utilised for all statistical analyses, including cross-tabulation, regression, and summary statistics.

2.7. Robustness check and heterogenous effects

To validate the reliability of our results, we undertook a sensitivity analysis using the original five categories of self-care limitations rather than the reclassified three categories. In addition, we explored possible variations in the association between co-occurring dementia and chronic pain with self-care limitations through subgroup analyses based on age and gender.

3. Results

Table 1 provides a summary of the study participants' weighted sample characteristics. The result showed that in 2015, 12.27 % (95 % CI: 11.71–12.86) of older Australians had profound or severe self-care limitations, while 5.10 % (95 % CI: 4.76–5.46) and 32.50 % (95 % CI: 31.52–33.50) had dementia and chronic pain, respectively. The data from 2018 indicates a decrease in the weighted percentage of people experiencing profound or severe self-care limitations (11.24 %, 95%CI: 10.67–11.84) and chronic pain (30.38 %, 95 % CI: 29.37–31.41) compared to the figures reported in 2015. Moreover, in 2018, the proportion of female respondents was 53.18 % (95 % CI: 52.42–53.93), and 12.55 % (95 % CI: 11.84–13.30) were 85 years of age or older.

Fig. 2 illustrates the proportion of self-care limitations among people living with dementia from 2015 to 2018. Among the people living with dementia, the proportion of profound or severe self-care limitations increased from 30.85 % in 2015 to 32.41 % in 2018. In the pooled data, a significant proportion of older adults living with dementia experienced self-care limitations, with 4.47 % reporting mild or moderate and 31.63 % reporting profound or severe self-care limitations.

Fig. 3 depicts the proportion of self-care limitations among people with chronic pain between 2015 and 2018. During this period, the proportion of profound or severe self-care limitations among those with chronic pain showed a slight decline, from 67.58 % in 2015 to 66.38 % in 2018. In the pooled data, a substantial proportion of older adults with chronic pain experienced self-care limitations, with 62.42 % reporting mild or moderate and 66.98 % reporting profound or severe self-care limitations.

The bivariate analyses examining the association of dementia, chronic pain, and other covariates with self-care limitations can be found in Appendix Table A1 of the supplementary documents. The bivariate analyses showed that self-care limitation was significantly associated with dementia, chronic pain status and other covariates at a 5 % level of significance. Additionally, Appendix Tables A2 and A3 provide the distribution of characteristics of study variables for the years 2015, 2018 and pooled data categorised by exposure group (chronic pain and dementia).

Table 2 presents the results from ordered logistic regression, highlighting the relationship between dementia, chronic pain, and self-care limitations. In Model 1, the findings reveal that people living with dementia had higher odds of self-care limitations [adjusted odds ratio (aOR): 15.12, 95 % confidence interval (CI): 12.50–18.29] compared to those without dementia. Additionally, chronic pain was independently associated with increased self-care limitations (aOR: 5.98, 95 % CI: 5.49–6.52) compared to people without chronic pain. Model 2 examines the interaction between chronic pain and dementia in relation to self-care limitations. The findings suggest that people with chronic pain, but without dementia, had significantly higher odds of experiencing self-care limitations (aOR: 6.25, 95 % CI: 5.73–6.83) compared to those without either condition. This association was even stronger for those with dementia but without chronic pain, who exhibited even greater odds of self-care limitations (aOR: 19.77, 95 % CI: 15.41–25.36). The combined presence of both dementia and chronic pain further amplified the risk, with a substantially increased likelihood of self-care limitations (aOR: 66.54, 95 % CI: 52.27–84.69) compared to people without either condition.

Table 3 presents the average marginal effects of self-care limitations (with dementia and chronic pain) based on the regression results from Model 1 in Table 2. The findings indicate that people with dementia were 47 % points less likely to have no self-care limitations compared to those without dementia. However, the probability of experiencing self-care limitations for people with dementia was 9 % points more likely to have mild or moderate limitations, and 38 % points more likely to experience profound or severe limitations compared to peers without dementia. Likewise, the probability of experiencing self-care limitations for people with chronic pain was 10 % points more likely to have mild or moderate limitations, and 15 % points more likely to experience profound or severe limitations than their counterparts not experiencing chronic pain.

3.1. Sensitivity analysis

We conducted sensitivity analyses to assess the robustness of our findings by using the original five categories of self-care limitations instead of the combined three categories. The results of ordered logistic regression and average marginal effects, presented in Appendix Tables A4 and A5, respectively, remained consistent with the main analyses.

3.2. Heterogenous effect

Tables 4 and 5 present the results of ordered logistic regression used to assess whether the relationship between co-occurring dementia and chronic pain with self-care limitations differs by age and gender, respectively. Table 4 shows that people with both dementia and chronic pain had higher odds of self-care limitations across all age groups compared to those without either condition, consistent with the main regression findings. However, the magnitude of the association between co-occurring dementia and chronic pain with self-care limitations appears to diminish with increasing age. For example, among people aged 65–69 years, those with both dementia and chronic pain had significantly higher odds of experiencing self-care limitations (aOR: 102.46, 95 % CI: 45.56–230.41) compared to their counterparts without either condition. In contrast, among people aged 85 years and older with both dementia and chronic pain, the odds were lower but still notably elevated (aOR: 44.42, 95 % CI: 29.39–67.12).

Table 5 indicates that, regardless of gender, people with both dementia and chronic pain exhibited significantly higher odds of self-care limitations compared to those without either condition, which is consistent with the main findings. For example, males with both dementia and chronic pain had markedly increased odds of experiencing self-care limitations (aOR: 64.25, 95 % CI: 44.15–93.53) than those without either condition.

4. Discussion

This study investigated older Australians aged 65 years and over from a nationally representative Survey of Disability, Ageing and Carers (SDAC) dataset to ascertain the association of dementia, and chronic pain with self-care limitations. The study further examined the association of co-occurring dementia and chronic pain with self-care limitations. The study found that dementia and chronic pain independently are associated with increased odds of self-care limitations. However, the most concerning finding is the interaction effect, which suggests that co-occurring dementia and chronic pain significantly amplify a person's self-care limitations.

The results showed that dementia is associated with self-care limitations, which is consistent with earlier research in which it was found that as dementia progresses, cognitive impairment makes it more difficult for people to engage in regular tasks (self-care domain) (Barberger-Gateau et al., 2002; Muò et al., 2005; Rocha et al., 2013). According to a previous study conducted in the USA, people with dementia were more likely to indicate functional limitations in 11 out of the 12 activity

Table 1
Background characteristics of the study participants.

	2015			2018			Pooled		
Characteristics	Unweighted *n* = 20,671	Weighted *N* = 3,546,360	Weighted % (95 % CI)	Unweighted n = 20,081	Weighted N = 3,909,217	Weighted % (95 % CI)	Unweighted *n* = 40,752	Weighted *N* = 7,455,577	Weighted % (95 % CI)
Level of self-care limitations									
No self-care limitations	8820	2800,086	78.96 (78.14–79.75)	8277	3,109,750	79.55 (78.67–80.41)	17,097	5,909,836	79.27 (78.66–79.86)
Moderate or Mild	1161	311,026	8.77 (8.19–9.39)	1080	359,931	9.21 (8.55–9.90)	2241	670,957	9.00 (8.55–9.46)
Profound or severe	10,690	435,248	12.27 (11.71–12.86)	10,724	439,536	11.24 (10.67–11.84)	21,414	874,784	11.73 (11.33–12.15)
Dementia									
No	15,009	3,365,573	94.90 (94.54–95.24)	14,209	3,704,791	94.77 (94.36–95.15)	29,218	7,070,364	94.83 (94.56–95.09)
Yes	5662	180,787	5.10 (4.76–5.46)	5872	204,426	5.23 (4.85–5.64)	11,534	385,213	5.17 (4.91–5.44)
Chronic Pain									
No	9928	2,393,742	67.50 (66.50–68.48)	9363	2,721,548	69.62 (68.59–70.63)	19,291	5,115,290	68.61 (67.89–69.32)
Yes	10,743	1,152,618	32.50 (31.52–33.50)	10,718	1,187,669	30.38 (29.37–31.41)	21,461	2,340,287	31.39 (30.68–32.11)
Age									
65–69	3823	1,148,837	32.39 (31.31–33.50)	3406	1,200,980	30.72 (29.6–31.86)	7229	2,349,817	31.52 (30.73–32.31)
70–74	3135	859,840	24.25 (23.30–25.22)	3357	1,025,845	26.24 (25.21–27.30)	6492	1,885,685	25.29 (24.58–26.01)
75–79	2972	630,363	17.77 (16.94–18.64)	2854	705,799	18.05 (17.18–18.96)	5826	1,336,161	17.92 (17.31–18.55)
80–84	3183	443,627	12.51 (11.81–13.25)	3056	485,834	12.43 (11.7–13.19)	6239	929,461	12.47 (11.96–12.99)
85 and above	7558	463,693	13.08 (12.40–13.78)	7408	490,759	12.55 (11.84–13.30)	14,966	954,453	12.80 (12.30–13.32)
Gender									
Male	8033	1,654,433	46.65 (45.95–47.36)	7831	1,830,346	46.82 (46.07–47.58)	15,864	3,484,779	46.74 (46.22–47.26)
Female	12,638	1,891,927	53.35 (52.64–54.05)	12,250	2,078,871	53.18 (52.42–53.93)	24,888	3,970,799	53.26 (52.74–53.78)
Accessibility and remoteness index									
Major cities in Australia	13,505	2,378,783	67.08 (65.86–68.27)	13,472	2,622,707	67.09 (65.80–68.35)	26,977	5,001,490	67.08 (66.20–67.96)
Inner regional Australia	4535	760,615	21.45 (20.39–22.54)	4448	883,523	22.60 (21.48–23.76)	8983	1,644,138	22.05 (21.28–22.85)
Outer regional and remote area	2631	406,962	11.48 (10.72–12.27)	2161	402,987	10.31 (9.54–11.13)	4792	809,950	10.86(10.32–11.43)
Country of birth									
Australia	13,872	2,285,906	64.46 (63.29–65.61)	13,228	2,533,537	64.81 (63.58–66.02)	27,100	4,819,442	64.64 (63.79–65.48)
English Speaking Countries	2853	523,733	14.77 (13.97–15.60)	2709	557,465	14.26 (13.44–15.13)	5562	1,081,198	14.50 (13.92–15.10)
Non-English-speaking countries	3946	736,721	20.77 (19.78–21.80)	4144	818,215	20.93 (19.88–22.03)	8090	1,554,937	20.86 (20.13–21.61)
State or territory									
New South Wales	5470	1,189,051	33.53 (32.26–34.82)	5901	1,287,503	32.94 (31.65–34.25)	11,371	2,476,554	33.21 (32.30–34.13)
Victoria	4543	892,056	25.15 (24.03–26.31)	4761	991,202	25.36 (24.19–26.55)	9304	1,883,258	25.26 (24.45–26.09)
Queensland	2994	680,240	19.18 (18.16–20.25)	3144	765,485	19.58 (18.56–20.64)	6138	1,445,725	19.39 (18.66–20.14)
South Australia	2979	293,550	8.28 (7.75–8.84)	2030	318,212	8.14 (7.18–9.21)	5009	611,762	8.21 (7.63–8.82)
Western Australia	2403	336,270	9.48 (8.86–10.15)	2800	373,252	9.55 (8.97–10.16)	5203	709,521	9.52 (9.09–9.96)
Tasmania	1260	93,609	2.64 (2.39–2.91)	895	103,695	2.65 (2.34–3.00)	2155	197,304	2.65 (2.44–2.87)
Northern Territory	225	14,076	0.40 (0.33–0.47)	133	16,137	0.41 (0.29–0.58)	358	30,212	0.41 (0.33–0.49)
Australian Capital Territory	797	47,508	1.34 (1.20–1.49)	417	53,732	1.37 (1.17–1.61)	1214	101,240	1.36 (1.23–1.50)

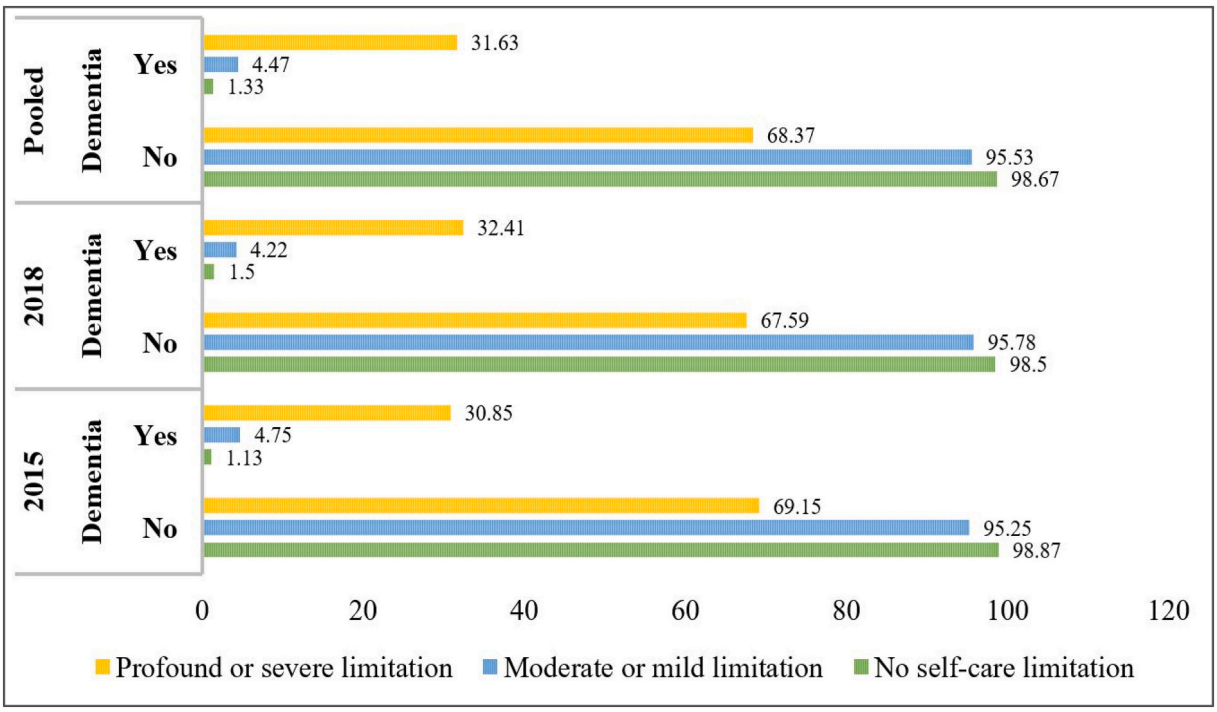

Fig. 2. Weighted prevalence of self-care limitations by the dementia status.

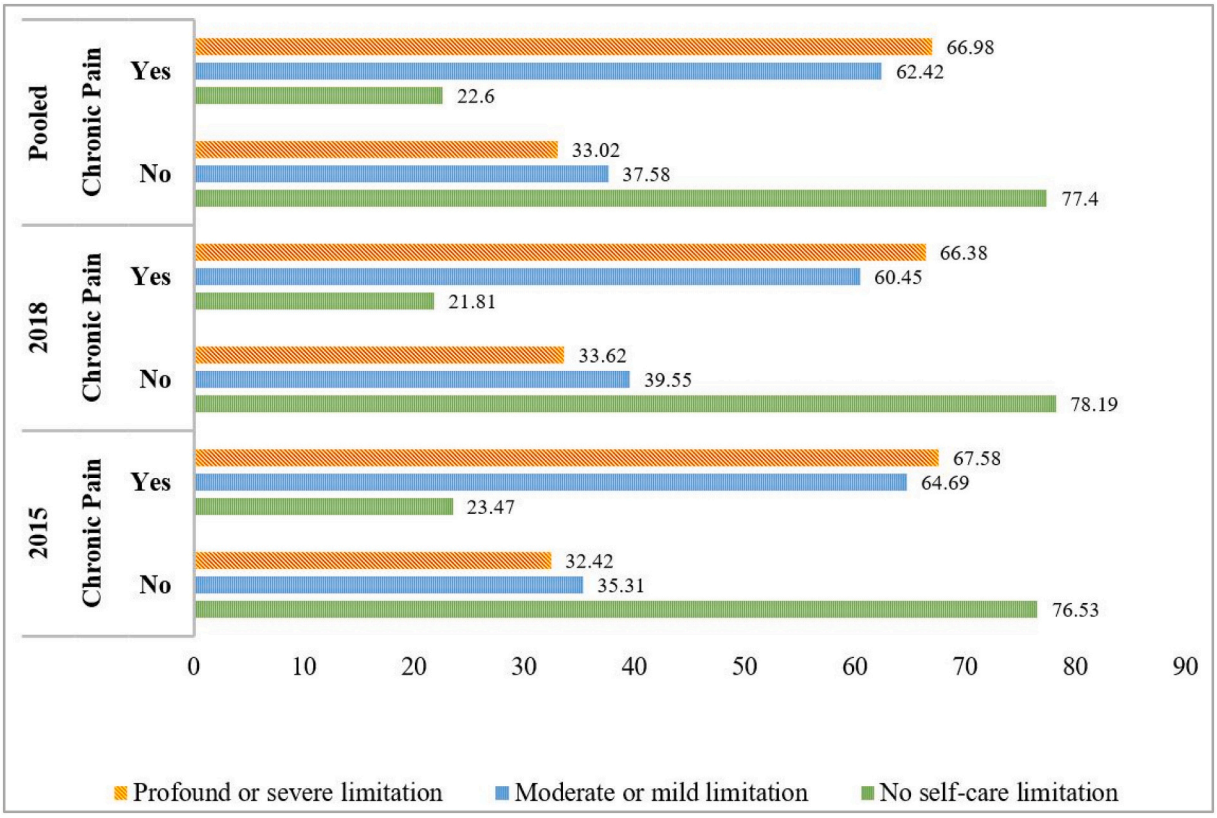

Fig. 3. Weighted prevalence of self-care limitations by the chronic pain status.

categories, and respondents with dementia-related functional limitations reported a greater mean number of limited activities (6.84 versus 4.87 in the cohort without dementia-related functional limitations) (Arrighi et al., 2010).

This study revealed that chronic pain was associated with greater self-care limitations. Earlier studies on older adults indicated that worse pain, that is,—more pervasive or intense pain, has a bigger impact on daily activities (Dueñas et al., 2020; Montgomery et al., 2016; Perneros

Table 2
Ordered logistic regression examining the association of dementia and chronic pain with self-care limitation, Pooled data.

	Model 1	Model 2
	Level of self-care limitation	Level of self-care limitation
	aOR (95%CI)	aOR (95%CI)
Dementia		
No (ref)		
Yes	15.12 *** (12.50–18.29)	
Chronic pain		
No (ref)		
Yes	5.98*** (5.49–6.52)	
Group comparison in the interaction between dementia and chronic pain status		
No dementia and no chronic pain (ref)		1.0 (Reference)
No dementia but has chronic pain		6.25***(5.73–6.83)
Has dementia but no chronic pain		19.77***(15.41–25.36)
Has dementia and chronic pain		66.54***(52.27–84.69)

Notes: 1. P-values: ***P < 0.001.
2. Abbreviations: ref. = Reference; aOR = Adjusted Odds Ratio; CI = Confidence Interval;
3. Only exposure variables are reported in the adjusted models 1 and 2.
4. The models are adjusted with age, accessibility and remoteness index, country of birth, and state.

Table 3
Relevant marginal effects results for ordered logistic regressions.

Self-care limitation score	Level of self-care limitation	Level of self-care limitation
	Variable of interest- dementia	Variable of interest- chronic pain
	Marginal effect, P value	Marginal effect, P value
0	−0.47; 0.001	−0.25; 0.001
1	0.09; 0.001	0.10; 0.001
2	0.38; 0.001	0.15, 0.001

Note: Self-care limitation score: 0 = No self-care limitation, 1 = mild or moderate self-care limitation, and 2 = severe or profound self-care limitation.

and Tropp, 2009). Another study also revealed that the severity of chronic back pain affected the quality of life regarding one's health, symptoms of depression and anxiety, the ability to work and carry out daily activities, and the quantity of healthcare used (Stamm et al., 2016). These researchers indicated that, even if pain cannot be removed entirely, therapies that lessen the intensity of the pain may still improve several health outcomes. This might be because people with chronic pain worry about physical activity since it could exacerbate their anguish (Friedrich et al., 2009; Nijs et al., 2008).

This study also demonstrated that co-occurring dementia and chronic pain were associated with greater self-care limitations. Notably, no prior studies have investigated this specific association. While related research in the USA has identified connections between co-existing dementia and visual impairment (Patel et al., 2020) or sensory limitations (Assi et al., 2021) with functional limitations, these studies did not explore chronic pain as a co-occurring factor. The findings of our study extend existing knowledge by highlighting the magnified impact of dementia alongside chronic pain on self-care limitations in older adults.

Policymakers and public health professionals seeking to measure and manage this growing burden at the population level may find these insights on the nature and extent of disability in dementia and chronic pain co-occurring in people to be valuable. At the policy level, there are a few current programmes in place related to self-care, but there is no evidence that they successfully target those people who require the most assistance with self-care and self-management. The current self-care related programmes include consumer-directed care arrangements in which eligible older adults receive a pre-determined fixed subsidy that can be used for various self-care services (such as physical fitness activities, social engagement and inclusion, and medical equipment) but not for medication (Duggan et al., 2017). However, in the absence of a deliberate national strategy that provides a formal definition of self-care and additional guidance on how these funds can be used to support self-care, it is unlikely that consumer-directed care will significantly impact self-care practices. Regarding chronic pain, a prior study found that more severe and extensive pain and the self-perception of pain's impact on work and social life were associated with greater levels of limitations in ADLs (Dueñas et al., 2020). Hence, determining what makes some people more limited than others could help guide future prevention and treatment efforts to ensure that chronic pain does not have negative consequences for other family members or individual's own work, and social lives. This will assist in the development of future prevention and treatment programmes. Recently, the Australian government allocated $20 million to a pilot programme called Pain MedsCheck that will assist people in using medications to treat chronic pain (Duggan et al., 2017). As part of Pain MedsCheck, pharmacists will monitor people using medicine to treat chronic pain that has lasted three months or more. In addition to pharmacological intervention, Pain Australia's national pain strategy includes self-management techniques such as 'pacing' to prevent pain episodes, which involves sustaining a consistent level of daily activity, as well as physical exercise and mental health strategies such as mindfulness (Painaustralia, 2019). As intriguing as these and other contemporary initiatives may be, it is evident that a continuous, aligned, and personalised healthcare approach is needed to establish self-care priorities, especially in groups with the greatest need, as evidenced by the inadequacy of isolated programmes and projects. Future research may contribute to further refining the clinical practice guidelines currently used to manage pain and dementia.

The primary strength of this study is the use of the SDAC dataset, a nationally representative sample of the population (Schofield et al., 2019). This study is one of the first to investigate the association between dementia and chronic pain with self-care limitations in an Australian context. Moreover, this study considered the co-occurrence of dementia and chronic pain, a prevalent co-morbidity with self-care limitations, which is barely explored in previous studies.

While interpreting the findings, it is crucial to consider the limitations of the study. First, the cross-sectional research design prevented this study from determining the causal links between self-care limitations and the co-occurrence of dementia and chronic pain. Second, since the data on disability were mostly collected from aged-care facilities, information about several socio-economic characteristics was unavailable, restricting this study from incorporating all confounders into the adjusted model to provide a complete case analysis. Hence, there is a possibility of systematic bias such as unmeasured confounders. Third, the measurement of chronic pain poses challenges due to its subjective nature and discrepancies in the formulation of questions used to assess chronic pain in survey instruments. People may encounter several forms of pain, such as cancer-related pain, neuropathic pain, and musculoskeletal pain. The surveys and data collections analysed in this research do not individually assess these specific categories, however rather aggregate them, posing challenges in exploring the various types of chronic pain prevalent in Australia. Finally, self-reporting or proxy-reporting poses a significant challenge, particularly in cases where a person's cognitive abilities are impaired, resulting in a protracted and ambiguous diagnosis process. Moreover, the presence of stigma may discourage people from identifying themselves. The SDAC may underestimate the prevalence of mild and moderate dementia among the household population. Identifying people with dementia, particularly at

Table 4
Heterogenous effect: group comparison in the interaction effect of cooccurring dementia and chronic pain with self-care limitations by age using ordered logistic regression, pooled data.

	Model 1	Model 2	Model 3	Model 4	Model 5
	Level of self-care limitations (Age 65–69)	Level of self-care limitations (Age 70–74)	Level of self-care limitations (Age 75–79)	Level of self-care limitations (Age 80–54)	Level of self-care limitations (Age 85 years and over)
	aOR (95%CI)	aOR (95%CI)	aOR (95%CI)	aOR (95%CI)	aOR (95%CI)
Dementia and chronic pain interaction					
No dementia and no chronic pain (ref)					
No dementia but has chronic pain	8.99*** (7.37–10.95)	7.19*** (5.89–8.78)	6.24*** (5.09–7.63)	4.78*** (3.90–5.86)	4.43*** (3.69–5.31)
Has dementia but no chronic pain	73.70*** (24.44–222.23)	20.46*** (9.98–41.98)	16.15*** (9.41–27.71)	19.03*** (11.32–31.98)	13.92*** (9.42–20.55)
Has dementia and chronic pain	102.46*** (45.56–230.41)	78.86*** (44.34–140.23)	75.69*** (45.43–126.12)	61.80*** (36.02–106.04)	44.42*** (29.39–67.12)

Notes: 1. P-values: ***P < 0.001.
2. Abbreviations: ref. = Reference; aOR = Adjusted Odds Ratio; CI = Confidence Interval.
3. Only exposure variables are reported in the adjusted models 1–5.
4. The models are adjusted with age, accessibility and remoteness index, country of birth, and state.

Table 5
Heterogenous effect: group comparison in the interaction effect of cooccurring dementia and chronic pain with self-care limitations by gender using ordered logistic regression, pooled data.

	Model 1	Model 2
	Level of self-care limitations (Gender: Male)	Level of self-care limitations (Gender: Female)
	aOR (95%CI)	aOR (95%CI)
Dementia and chronic pain interaction		
No dementia and no chronic pain (ref)		
No dementia but has chronic pain	6.28*** (5.49–7.18)	6.23*** (5.55–6.99)
Has dementia but no chronic pain	18.22*** (12.54–26.48)	21.20*** (15.27–29.43)
Has dementia and chronic pain	64.25*** (44.15–93.53)	67.30*** (49.48–91.53)

Notes: 1. P-values: ***P < 0.001.
2. Abbreviations: ref. = Reference; aOR = Adjusted Odds Ratio; CI = Confidence Interval;
3. Only exposure variables are reported in the adjusted models 1 and 2.
4. The models are adjusted with age, accessibility and remoteness index, country of birth, and state.

advanced ages, is complicated by co-occurring health conditions that obscure dementia symptoms. The aforementioned obstacles will likely influence the data collected via self-administered or proxy-based questionnaires. However, earlier population-based research frequently utilised self-reported data (Assi et al., 2021; Frank et al., 2019; Patel et al., 2020).

5. Conclusions

In conclusion, this study sheds light on the significant challenges faced by Australian older adults living with both dementia and chronic pain. The results, based on a nationally representative sample, showed that dementia and chronic pain were independently associated with self-care limitations. Furthermore, the group comparison in the interaction effect reveals that co-occurring dementia and chronic pain were associated with significantly higher self-care limitations.

These findings have significant implications for improving the health of older people with dementia. Given the potential for chronic pain treatment to alleviate the constraints associated with dementia, it is critical to investigate low-cost and easily accessible pain management solutions customized to this demographic. This might include non-pharmacological therapies like physical therapy, relaxation methods, or cognitive-behavioural therapy approaches tailored to people with dementia.

Further study is urgently required to validate the reported interaction effect and understand possible mechanisms. Studies exploring the specific types of chronic pain experienced by older people with dementia, as well as their influence on self-care limitations, might be beneficial. Furthermore, studying the efficacy of various pain treatment techniques in older adults is critical for informing clinical practice and improving care. By managing chronic pain, we may be able to considerably enhance or preserve the functional abilities of older people, especially those with dementia, enabling them to live more satisfying lives.

Abbreviations

ABS	Australian Bureau of Statistics
ADL	Activities of Daily Living
ARIA	Accessibility Remoteness Index of Australia
CI	Confidence Interval
IADL	Instrumental Activities of Daily Living
OR	Odds Ratio
SDAC	Survey of Disability, Ageing, and Carers
WHO	World Health Organization

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CRediT authorship contribution statement

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

draft, Visualization, Validation, Supervision, Conceptualization. **Syed Afroz Keramat:** Writing – review & editing, Writing – original draft, Supervision, Software, Methodology, Conceptualization.

Ethics approval and consent to participate

Data for SDAC were collected by the Australian Bureau of Statistics (ABS) under the provisions of the Census and Statistics Act (CSA) 1905. Prior to field operations, the survey was submitted to the Australian Privacy Commissioner and tabled in parliament. Confidentiality of these data is guaranteed under the Act, and information was provided freely by respondents. This study did not require ethical approval as the dataset is from publicly de-identified available data, and data were made available to the authors through the ABS and Universities Australia agreement.

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.

Declaration of competing interest

We declare no competing interests.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jad.2024.10.046.

Data availability

Data for this study are available to registered users of Australian Bureau of Statistics microdata (https://www.abs.gov.au/statistics/microdata-tablebuilder). For information about eligible organisations, see https://www.abs.gov.au/statistics/microdata-tablebuilder/absuniversities-australia-agreement

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