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Three-Year Trajectories of Functional Change, Cognitive Symptoms and Frailty Among Older Chinese-Speaking Adults in Australia

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Abstract

Purpose

This study examined three-year changes in functional change, cognitive symptoms, frailty and depressive symptoms among older Chinese-speaking adults in Australia.

Method

A longitudinal cohort of 114 participants was followed across 2023, 2024 and 2025. Outcomes were assessed using the Healthy Brain Ageing–Functional Assessment Questionnaire, AD8, FRAIL Scale and five-item Geriatric Depression Scale, and analysed using linear mixed-effects models.

Major findings

Functional change and cognitive symptom scores increased significantly from 2023 to 2024 and remained stable in 2025. Frailty scores were stable between 2023 and 2024 but increased significantly in 2025, whereas depressive symptom scores showed no significant change. Complete-case sensitivity analyses supported these findings.

Conclusions

The results suggest that functional and cognitive vulnerability may emerge before measurable increases in frailty. Longitudinal, culturally responsive monitoring may support earlier identification and timely intervention among older Chinese-speaking.

Introduction

Healthy ageing is increasingly understood as a multidimensional process that extends beyond the absence of disease (Beard et al., 2016; Menassa et al., 2023). The World Health Organization defines healthy ageing as the process of developing and maintaining the functional ability that enables well-being in older age (WHO, 2015). This functional ability reflects the interaction between an individual's intrinsic capacity, the environments in which they live, and the supports available to maintain independence and participation. In later life, functional ability may be affected by gradual changes in cognition, physical capacity, frailty, mood, social participation and everyday activities (Zhou & Ma, 2022). Monitoring these changes over time is therefore important for identifying emerging vulnerability before substantial decline occurs.

Functional change, cognitive symptoms, frailty and depressive symptoms are closely related but may follow different trajectories (Ji et al., 2024; Yuan et al., 2023). Cognitive symptoms can affect memory,

judgement, communication, social engagement and the ability to manage complex everyday tasks (Blazer, 2013; Jekel et al., 2015). Frailty reflects reduced physiological reserve and increased vulnerability to adverse outcomes, including falls, hospitalisation, disability and loss of independence (Fried et al., 2001; Xue, 2011). Depressive symptoms may also influence motivation, social participation, physical function and perceived cognitive ability (Komalasari et al., 2022; Sharifian et al., 2020). Although these domains often overlap, they may not change at the same rate. For example, early functional or cognitive changes may be detectable before measurable increases in frailty, while depressive symptoms may remain stable or fluctuate depending on social and health-related circumstances (Sutin et al., 2013; Yuan et al., 2023). Longitudinal studies are therefore essential for understanding how these domains evolve over time.

This issue is particularly important for culturally and linguistically diverse older adults, including Chinese-speaking communities in Australia (Gaviola et al., 2024; Gilbert et al., 2022). Chinese-speaking older adults may experience unique ageing-related challenges shaped by migration history, language preference, cultural expectations of family support, health literacy, social isolation and access to culturally responsive health and aged care services. Language and cultural barriers may delay help-seeking, reduce access to early assessment and make subtle functional or cognitive changes less visible to mainstream services (Haralambous et al., 2014; Iwuagwu et al., 2024). At the same time, many older Chinese-speaking adults remain highly connected to community organisations, which can provide important opportunities for culturally appropriate health screening, education and longitudinal monitoring (Haralambous et al., 2014; Kirwan et al., 2025).

Australia's ageing population is increasingly diverse, and Chinese-born residents represent one of the largest migrant communities. As this population ages, there is a growing need to understand ageing-related vulnerability in ways that are culturally and linguistically appropriate (Bryant & Lim, 2013; Haralambous et al., 2014). Existing research has highlighted the importance of dementia risk, cognitive ageing, frailty and mental health among older adults; however, longitudinal evidence focusing on Chinese-speaking older adults in Australia remains limited (Cheng et al., 2025; Patel et al., 2022). Much available evidence is cross-sectional or based on short follow-up periods, making it difficult to determine whether functional, cognitive, frailty-related and depressive symptoms change in parallel or show distinct patterns over time (Cheng et al., 2025; Xie et al., 2021; Yuan et al., 2023).

The Healthy Brain Ageing–Functional Assessment Questionnaire (HBA-FAQ) provides a structured way to assess perceived functional change across multiple domains of everyday life, including self-care, financial affairs, social/work functioning, household tasks, everyday technology, sleep, memory, higher-level thinking, emotion regulation and behaviour change (Lin et al., 2023). When used alongside brief measures such as the AD8, FRAIL Scale and five-item Geriatric Depression Scale, it allows a broader assessment of functional, cognitive, physical and emotional aspects of ageing (Galvin et al., 2005; Hoyl et al., 1999; Morley et al., 2012). Repeated assessment using these tools may help identify early functional vulnerability and inform culturally responsive prevention, referral and care planning (Cao et al., 2022; Cheng et al., 2025; Cui et al., 2023; Yuan et al., 2023).

This study extends previous work by examining three-year longitudinal patterns in functional change, cognitive symptoms, frailty and depressive symptoms among older Chinese-speaking adults in Australia. Using data collected across 2023, 2024 and 2025, the study applied linear mixed-effects models to examine changes over time while accounting for repeated observations within individuals. The study aimed to identify whether functional change, cognitive symptoms, frailty and depressive symptoms showed similar or different trajectories across the three-year follow-up. A further aim was to explore domain-level patterns within the HBA-FAQ to identify which areas of functional change were most sensitive to change over time. Findings from this study may contribute to improved understanding of ageing-related vulnerability among Chinese-speaking older adults and support the development of culturally responsive monitoring, early identification and intervention strategies.

Materials and Methods

Study design and participants

This study used a three-wave longitudinal cohort design to examine changes in functional, cognitive, frailty-related and depressive symptom outcomes among older Chinese-speaking adults in Australia. Data were collected across three survey years: 2023, 2024 and 2025. The study was conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Survey instrument and variables

Participants were recruited through Chinese community organisations in Sydney, New South Wales, Australia. The study focused on community-dwelling older Chinese-speaking adults from culturally and linguistically diverse backgrounds. Eligible participants were older adults of Chinese background who were able to complete the study questionnaires in Chinese and participate in community-based data collection activities. Participants with severe physical, mental or cognitive conditions that prevented questionnaire completion were not included.

As with any community organisation-based recruitment strategy, this approach likely favoured individuals who were sufficiently mobile, cognitively able, and socially engaged to participate in organised community activities, and is likely to have under-represented more socially isolated, frail, or cognitively impaired older adults; this is discussed further in the Limitations.

At baseline in 2023, 117 participants were included in the total sample. Of these, 114 participants contributed valid outcome data to the longitudinal analytic sample. Across the three survey waves, participants contributed 332 participant-year records. Most participants completed all three waves.

Measures

Demographic and health characteristics

Demographic and health-related information was collected at baseline, including age, gender, education level, years since migration to Australia, first language, language spoken at home, country of birth, Aboriginal or Torres Strait Islander status, chronic disease diagnosis and diagnosed psychological or mental disorder. Free-text responses were used to identify specific chronic diseases and psychological or mental health conditions.

Healthy Brain Ageing–Functional Assessment Questionnaire (HBA-FAQ)

Functional change was assessed using the Healthy Brain Ageing–Functional Assessment Questionnaire (HBA-FAQ) (Lin et al., 2023). The HBA-FAQ includes 44 items across 10 domains: self-care, financial affairs, social/work functioning, household tasks, everyday technology, sleep, memory, higher-level thinking, emotion regulation and behaviour change. Items assess perceived changes in everyday functioning and are scored from 0 to 3, with higher scores indicating greater functional change or impairment. Domain scores were calculated as mean scores for the relevant items. Overall HBA-FAQ mean scores were also calculated. For the social/work functioning domain, N/A responses coded as 4 were treated as missing before corrected domain mean scores were calculated.

Ascertain Dementia 8 (AD8)

Cognitive symptoms were assessed using the AD8, an eight-item screening measure of cognitive change (Galvin et al., 2005; Galvin et al., 2006). Each item is scored as 0 or 1, with total scores ranging from 0 to 8. Higher scores indicate greater cognitive symptom burden.

FRAIL Scale

Frailty was assessed using the FRAIL Scale, which includes five components: fatigue, resistance, ambulation, illness and loss of weight (Morley et al., 2012; Woo et al., 2015). Each item is scored as 0 or 1, producing a total score ranging from 0 to 5. Higher scores indicate greater frailty.

Five-item Geriatric Depression Scale (GDS-5)

Depressive symptoms were assessed using the five-item Geriatric Depression Scale (GDS-5) (Hoyl et al., 1999; Rinaldi et al., 2003). Items are scored as 0 or 1, with total scores ranging from 0 to 5. Higher scores indicate greater depressive symptom burden.

Consistent with the HBA-FAQ developers' description of the instrument as a self/informant-report screening measure of perceived functional change rather than a diagnostic tool, HBA-FAQ, AD8 and FRAIL scores in this study are interpreted as screening indicators of risk and perceived change, not as clinical diagnoses of cognitive impairment, dementia, or frailty.

Translation and cultural adaptation

All instruments were translated into Mandarin and back-translated into English by bilingual research team members to support conceptual and cultural equivalence; discrepancies were resolved by team consensus. Following back-translation, two older people and organisation coordinator reviewed, Mandarin versions for readability and understandability, informing minor wording refinements. All instruments were administered in Mandarin at all three survey waves, ensuring consistent language of administration across time points.

Data collection

Data were collected by trained community-based coordinators in collaboration with the research team. Coordinators supported participants to complete the demographic survey and the outcome measures, including the HBA-FAQ, AD8, FRAIL Scale and GDS-5. Data collection was conducted at three time points corresponding to the 2023, 2024 and 2025 survey waves. The same cohort of researchers and community-based coordinators conducted data collection across all three survey waves, supporting consistency in administration procedures throughout the three-year follow-up.

Ethical considerations

Ethical approval

was granted by the Human Research Ethics Committee of the University of New England (Approval No. HE22-088). Participants were provided with information about the study before taking part, and participation was voluntary. Data were handled confidentially and analysed in de-identified form.

Statistical analysis

Data were analysed using IBM SPSS Statistics v31. Descriptive statistics were used to summarise participant characteristics, completion patterns and outcome scores across the three survey years: 2023, 2024 and 2025. Continuous variables were reported as means and standard deviations, while categorical variables were reported as frequencies and percentages.

Outcome scores were calculated for functional change, cognitive symptoms, frailty and depressive symptoms using the HBA-FAQ, AD8, FRAIL Scale and GDS-5, respectively. HBA-FAQ domain scores were calculated as mean scores for the relevant domains, including self-care, financial affairs, social/work functioning, household tasks, everyday technology, sleep, memory, higher-level thinking, emotion regulation and behaviour change. Higher scores indicated greater functional change or symptom burden. For the social/work functioning domain, N/A responses coded as 4 were treated as missing before corrected domain mean scores were calculated.

To examine longitudinal changes, the dataset was reshaped from wide format to long format, with each participant contributing up to three observations corresponding to 2023, 2024 and 2025. Linear mixed-effects models were fitted for each main outcome. Survey year was entered as a fixed effect, and participant ID was included as a random intercept to account for repeated observations within

individuals. Estimated marginal means were calculated for each year. Bonferroni-adjusted pairwise comparisons were conducted to identify which survey years differed significantly, with detailed pairwise results reported in Supplementary Table S1.

The primary mixed-model analyses used all available valid observations. Complete-case sensitivity analyses were conducted to assess the robustness of the main mixed-model findings, with complete cases defined as participants with valid data for the relevant outcome across all three survey years. These results are reported in Supplementary Table S2. Additional HBA-FAQ domain-level mixed-effects models were conducted to explore whether functional change differed across specific domains, with findings reported in Supplementary Table S3.

Statistical significance was set at $p < .05$.

Results

Participants showed high follow-up completion across the three-year period. Functional change and cognitive symptoms increased from 2023 to 2024 and then remained stable in 2025, while frailty increased later, with higher scores observed in 2025. Depressive symptoms remained stable across all three years. Complete-case sensitivity analyses supported the robustness of these longitudinal patterns.

Participant characteristics at baseline

At baseline in 2023, the total sample included 117 participants. The mean age was 72.06 years (SD = 6.69; range 64–95), and participants had lived in Australia for an average of 19.44 years (SD = 12.79; range 1–56). Among participants with valid gender data, most were female (n = 93, 81.6%). Most participants reported Mandarin or Cantonese as their first language (n = 106, 93.0%) and as the language spoken at home (n = 109, 95.6%). The majority were born in China (n = 102, 89.5%), followed by Hong Kong (n = 6, 5.3%), Indonesia (n = 3, 2.6%) and Vietnam (n = 3, 2.6%). No participants with valid responses identified as Aboriginal or Torres Strait Islander.

Educational attainment varied, with high school certificate completion being the most common level of education (n = 55, 48.2%), followed by bachelor's degree completion (n = 32, 28.1%) and training college completion (n = 16, 14.0%). More than half of participants reported having a diagnosed chronic disease (n = 70, 61.4%). The most commonly reported chronic conditions were hypertension (n = 39, 33.3%), arthritis (n = 26, 22.2%) and diabetes (n = 11, 9.4%). A smaller proportion reported a diagnosed psychological or mental disorder (n = 12, 10.5%), with anxiety being the most commonly reported condition (n = 7, 6.0%). (See Table 1).

Table 1
Baseline characteristics of participants in 2023

Characteristic	Total sample
Total participants	117
Age, years, mean ± SD [range]	72.06 ± 6.69 [64–95]
Years since migration to Australia, mean ± SD [range]	19.44 ± 12.79 [1–56]
Gender, n (%)	
Female	93 (81.6)
Male	21 (18.4)
Education level, n (%)	
Training college completed	16 (14.0)
High school certificate completed	55 (48.2)
Bachelor's degree completed	32 (28.1)
Master's degree completed	1 (0.9)
Other	10 (8.8)
First language, n (%)	
English	3 (2.6)
Mandarin or Cantonese	106 (93.0)
Other language	5 (4.4)
Language spoken at home, n (%)	
English	1 (0.9)
Mandarin or Cantonese	109 (95.6)
Other language	4 (3.5)
Country of birth, n (%)	
China	102 (89.5)
Hong Kong	6 (5.3)
Indonesia	3 (2.6)
Vietnam	3 (2.6)

Note. Values are presented as n (%) unless otherwise stated. Percentages for categorical variables are based on valid responses. Specific chronic disease and psychological disorder categories were derived from free-text responses and are not mutually exclusive.

Characteristic	Total sample
Aboriginal or Torres Strait Islander, n (%)	
No	114 (100.0)
Diagnosed chronic disease, n (%)	
Yes	70 (61.4)
No	44 (38.6)
Most commonly reported chronic diseases among total sample, n (%)	
Hypertension	39 (33.3)
Arthritis	26 (22.2)
Diabetes	11 (9.4)
Heart disease/coronary heart disease	6 (5.1)
Cancer/lung cancer	4 (3.4)
Diagnosed psychological/mental disorder, n (%)	
Yes	12 (10.5)
No	102 (89.5)
Reported psychological/mental disorders, n (%)	
Anxiety	7 (6.0)
Depression	2 (1.7)
Note. Values are presented as n (%) unless otherwise stated. Percentages for categorical variables are based on valid responses. Specific chronic disease and psychological disorder categories were derived from free-text responses and are not mutually exclusive.	

Participant completion across the three-year follow-up

Across the three survey waves, 114 participants were included in the longitudinal analytic sample and contributed 332 participant-year records. Completion was high across the follow-up period. Most participants completed all three survey years (n = 105, 92.1%), while eight participants (7.0%) completed two years only and one participant (0.9%) completed one year only. All 114 participants had valid records in 2023, with 108 participants completing the 2024 survey and 110 completing the 2025 survey. The high level of repeated participation supported the use of longitudinal mixed-effects models to examine changes across the three-year follow-up (See Table 2).

Table 2
Participant completion across 2023–2025

Completion indicator	n	%
Unique participants in longitudinal analytic sample	114	100.0
Completed all three years	105	92.1
Completed two years only	8	7.0
Completed one year only	1	0.9
Completed records in 2023	114	100.0
Completed records in 2024	108	94.7
Completed records in 2025	110	96.5
Total participant-year records	332	—

Note. Percentages are based on the longitudinal analytic sample of 114 participants. Participant-year records refer to the total number of completed survey records contributed across 2023, 2024 and 2025.

Descriptive trends in functional, cognitive, frailty and depressive outcomes

Table 3 presents descriptive changes in functional change, cognitive symptoms, frailty and depressive symptoms across the three survey years. Overall, the descriptive patterns suggest that functional and cognitive symptom burden increased early in the follow-up period, frailty increased later, and depressive symptoms remained stable.

HBA-FAQ mean scores increased from 0.45 in 2023 to 0.62 in 2024, before remaining similar in 2025 at 0.61. This pattern suggests that participants experienced a greater level of reported functional change after baseline, with little further descriptive increase between 2024 and 2025. AD8 total scores showed a similar pattern, increasing from 1.60 in 2023 to 2.74 in 2024 and remaining broadly stable in 2025 at 2.68. This suggests an increase in reported cognitive symptoms from baseline to the first follow-up, followed by relative stability.

FRAIL scores followed a different pattern. Mean FRAIL scores were almost unchanged between 2023 and 2024, decreasing slightly from 0.90 to 0.88, but increased to 1.47 in 2025. This suggests that frailty-related burden may have emerged later in the follow-up period rather than increasing immediately after baseline. In contrast, GDS-5 scores remained highly stable across the three years, with mean scores of 1.88 in 2023, 1.86 in 2024 and 1.88 in 2025. This indicates no meaningful descriptive change in depressive symptom scores over time.

The number of valid observations varied slightly across outcomes and years because of missing data. These descriptive findings provide an initial summary of longitudinal patterns and were further examined using linear mixed-effects models (See Table 3).

Table 3
Descriptive changes in functional, cognitive, frailty and depressive symptom scores across 2023–2025

Outcome	2023 n	2023 Mean ± SD	2024 n	2024 Mean ± SD	2025 n	2025 Mean ± SD	Descriptive trend
HBA-FAQ mean score	114	0.45 ± 0.46	108	0.62 ± 0.54	110	0.61 ± 0.50	Increased from 2023, then remained stable
AD8 total score	114	1.60 ± 2.03	109	2.74 ± 2.36	114	2.68 ± 2.63	Increased from 2023, then remained similar
FRAIL score	114	0.90 ± 1.02	109	0.88 ± 1.05	110	1.47 ± 1.28	Stable to 2024, then increased in 2025
GDS-5 total score	114	1.88 ± 1.18	108	1.86 ± 1.03	110	1.88 ± 1.16	Stable across three years

Note. HBA-FAQ mean scores range from 0 to 3, AD8 total scores from 0 to 8, FRAIL scores from 0 to 5, and GDS-5 total scores from 0 to 5. Higher scores indicate greater functional change, cognitive symptoms, frailty or depressive symptoms, respectively.

Longitudinal changes in key outcomes using mixed-effects models

Linear mixed-effects models confirmed significant changes over time in HBA-FAQ, AD8 and FRAIL scores, but not in GDS-5 scores (Table 4). HBA-FAQ mean scores differed significantly across survey years, $F(2, 222.68) = 6.91$, $p = .001$. Bonferroni-adjusted pairwise comparisons showed that HBA-FAQ scores were significantly higher in 2024 and 2025 than in 2023, with no significant difference between 2024 and 2025. AD8 total scores also showed a significant year effect, $F(2, 226.50) = 12.86$, $p < .001$, with significantly higher scores in both 2024 and 2025 compared with 2023. FRAIL scores showed the strongest year effect, $F(2, 223.08) = 20.58$, $p < .001$, with scores significantly higher in 2025 than in both 2023 and 2024. In contrast, GDS-5 total scores did not change significantly over time, $F(2, 223.73) = 0.02$, $p = .978$, indicating stable depressive symptom scores across the three years.

Table 4
Linear mixed-effects model results for changes across 2023–2025

Outcome	2023 EMM (95% CI)	2024 EMM (95% CI)	2025 EMM (95% CI)	Overall year effect	p value	Significant pairwise comparisons
HBA-FAQ mean score	0.45 (0.36–0.55)	0.62 (0.52–0.71)	0.62 (0.53–0.71)	F(2, 222.68) = 6.91	.001	2024 > 2023, p = .005; 2025 > 2023, p = .004
AD8 total score	1.60 (1.16–2.03)	2.74 (2.30–3.18)	2.68 (2.25–3.12)	F(2, 226.50) = 12.86	< .001	2024 > 2023, p < .001; 2025 > 2023, p < .001
FRAIL score	0.90 (0.69–1.10)	0.86 (0.65–1.07)	1.48 (1.27–1.69)	F(2, 223.08) = 20.58	< .001	2025 > 2023, p < .001; 2025 > 2024, p < .001
GDS-5 total score	1.88 (1.67–2.08)	1.86 (1.64–2.07)	1.88 (1.67–2.09)	F(2, 223.73) = 0.02	.978	No significant pairwise differences

Note. EMM = estimated marginal mean; CI = confidence interval. Linear mixed-effects models included survey year as a fixed effect and participant ID as a random intercept. Pairwise comparisons were adjusted using the Bonferroni method. Higher scores indicate greater functional change, cognitive symptoms, frailty, or depressive symptoms.

Supplementary analyses of longitudinal change

Detailed Bonferroni-adjusted pairwise comparisons are presented in Supplementary Table S1. These comparisons showed that HBA-FAQ and AD8 scores were significantly higher in both 2024 and 2025 compared with 2023, with no significant difference between 2024 and 2025. FRAIL scores did not differ significantly between 2023 and 2024 but were significantly higher in 2025 than in both earlier years. GDS-5 scores showed no significant pairwise differences across the three survey years.

Complete-case sensitivity analyses are presented in Supplementary Table S2. These analyses produced findings consistent with the main mixed-model analyses, supporting the robustness of the observed longitudinal patterns. Specifically, HBA-FAQ and AD8 scores remained significantly higher in 2024 and 2025 than in 2023, FRAIL scores remained stable from 2023 to 2024 but increased significantly in 2025, and GDS-5 scores remained stable across the follow-up period.

HBA-FAQ domain-level findings are presented in Supplementary Table S3. These analyses suggested that functional change was not uniform across domains. Significant year effects were observed for self-care, social/work functioning, household tasks, everyday technology and behaviour change. Household tasks and everyday technology increased significantly from 2023 to both 2024 and 2025, while self-care increased significantly from 2023 to 2025 only. The corrected social/work functioning domain showed a significant year effect, with scores significantly higher in 2025 than in both 2023 and 2024. Behaviour change increased significantly in 2024 and remained significantly higher than 2023 in 2025. Financial

affairs, sleep, memory, higher-level thinking and emotion regulation showed no significant year effects. The higher-level thinking domain showed a trend toward significance ($F(2, 222.77) = 2.97$, $p = .054$) that did not reach the conventional threshold and should be interpreted as a borderline finding warranting attention in future, larger-sample follow-up rather than treated as equivalent to the clearly null domains (e.g., financial affairs, $p = .695$; memory, $p = .685$). For the social/work functioning domain, N/A responses coded as 4 were treated as missing before calculating corrected domain scores.

Discussion

This three-year longitudinal study examined changes in functional change, cognitive symptoms, frailty and depressive symptoms among older Chinese-speaking adults in Australia. The findings showed distinct longitudinal patterns across outcome domains. HBA-FAQ and AD8 scores increased from 2023 to 2024, indicating greater perceived functional difficulty and cognitive symptom burden, respectively, before remaining relatively stable in 2025.

Depressive symptoms remained stable across all three survey years. Together, these findings suggest that functional and cognitive changes may become evident earlier than measurable increases in frailty, while depressive symptom burden may remain relatively stable over the same period (Hu et al., 2025; Ji et al., 2024; Yuan et al., 2023).

These findings extend the earlier one-year analysis of this cohort, which suggested measurable increases in functional and cognitive difficulties between 2023 and 2024 (Lumbantoruan et al., 2025). The present three-year analysis provides a more nuanced picture by showing that these early increases did not continue linearly into 2025. Instead, functional change and cognitive symptoms appeared to increase early and then plateau, whereas frailty increased later. This pattern is consistent with ageing and dementia-related research suggesting that subtle functional changes in everyday activities, social participation, technology use and behavioural regulation may be detectable before more overt physical vulnerability becomes apparent (Cipriani et al., 2020; Jekel et al., 2015; Lydon et al., 2022; Raimo et al., 2024). It also supports the view that frailty is a cumulative and multidimensional process that may emerge progressively over time (Clegg et al., 2013; Doody et al., 2023; Fried et al., 2001).

The early increase in HBA-FAQ and AD8 scores is clinically meaningful because functional ability is central to healthy ageing (Beard et al., 2016). Functional change reflects whether older adults can maintain independence, social participation, family roles and everyday routines (Lin et al., 2023). In this study, the increase in HBA-FAQ scores from 2023 to 2024 suggests that participants reported greater perceived functional difficulty after baseline. The similar increase in AD8 scores indicates that cognitive symptoms also became more apparent during the same period. This alignment between functional and cognitive measures is consistent with previous studies showing that everyday functional change and cognitive symptoms are closely related, particularly in areas requiring planning, judgement, memory, communication and problem-solving (Cipriani et al., 2020; Jekel et al., 2015; Marshall et al., 2011).

The relative stability of HBA-FAQ and AD8 scores between 2024 and 2025 should not necessarily be interpreted as absence of vulnerability. Participants may have adapted to earlier functional changes, received informal support from family or community networks, or remained engaged in community activities that helped stabilise functioning (Beard et al., 2016; Tomioka et al., 2018). The stability may also reflect the characteristics of participants who remained in follow-up, as those experiencing more severe decline may have been less likely to continue participation (Hernandez et al., 2024; Jacobsen et al., 2021). Another possibility is that the measurement tools may have been less sensitive to subtle additional change once functional difficulties had already been reported (Grigorova et al., 2025; Lin et al., 2023; Passler et al., 2021).

Frailty showed a delayed pattern, with a significant increase emerging in 2025. This differs from the early increase observed for functional and cognitive symptoms. Frailty involves fatigue, reduced resistance and ambulation, illness burden and weight loss, and these indicators may accumulate gradually before becoming measurable. The later rise in FRAIL scores may therefore suggest that physical vulnerability became more evident after earlier functional and cognitive changes (Chen et al., 2018; Clegg et al., 2013). For older Chinese-speaking adults, this highlights the importance of monitoring frailty over multiple years, particularly when early changes are already visible in functional or cognitive domains.

In contrast, depressive symptoms remained stable across the three-year period. This suggests that the observed increases in functional, cognitive and frailty-related outcomes were not accompanied by a parallel increase in depressive symptom scores. This pattern is consistent with longitudinal evidence showing that frailty, cognitive impairment and depressive symptoms are related but may follow distinct or heterogeneous trajectories in later life (Hu et al., 2025; Yuan et al., 2023). This is important because depressive symptoms can influence perceived cognition, motivation, social engagement and physical functioning. The stability of GDS-5 scores may indicate that changes in HBA-FAQ, AD8 and FRAIL scores reflected specific functional, cognitive and physical vulnerability rather than a general increase in emotional distress (Hu et al., 2025; Yuan et al., 2023). Nevertheless, depressive symptoms remain important to monitor because they may interact with social isolation, chronic disease, frailty and help-seeking over longer periods (Adams et al., 2024; Feng et al., 2014).

The HBA-FAQ domain-level analyses showed that functional change was not uniform across domains. Significant year effects were observed for self-care, social/work functioning, household tasks, everyday technology and behaviour change. Perceived difficulties with household tasks and everyday technology were significantly greater in both 2024 and 2025 than in 2023, suggesting that these domains may be sensitive indicators of functional vulnerability (Jekel et al., 2015; Kelbling et al., 2024). Difficulties with household tasks may reflect changes in planning, initiation, physical energy or confidence in managing daily routines. Everyday technology is increasingly important for independence, communication, healthcare access and engagement with services, and may be particularly relevant for culturally and linguistically diverse older adults (Holthe et al., 2022; Iwuagwu et al., 2024).

The social/work functioning domain also showed a significant year effect, with scores significantly higher in 2025 than in both 2023 and 2024. This suggests that social participation and role-related functioning may become increasingly affected over time. Social and work-related functioning can be influenced by cognitive confidence, transport, language barriers, health status, community participation and changing family roles (Georgeou et al., 2023; Rotenberg et al., 2020; Townsend et al., 2021). Perceived behavioural difficulties also increased significantly over time, suggesting that behavioural changes may provide useful indicators for the early recognition of cognitive and functional vulnerability (Ismail et al., 2016; Jekel et al., 2015; Lanctôt et al., 2017). Although memory and higher-level thinking did not show significant domain-level year effects, the overall AD8 findings suggest that cognitive symptoms increased at the broader measure level.

A measurement-related limitation concerns the HBA-FAQ response format (Lin et al., 2023). Each item was scored using a limited ordinal scale, with responses coded from 0 to 3. Although this structure is practical for community-based data collection, it may have reduced sensitivity to subtle longitudinal changes. The relatively narrow response range may have contributed to ceiling or floor effects in some domains, making it difficult to detect further deterioration once participants had already reported functional change (Fries et al., 2011; Grigorova et al., 2025; Lin et al., 2023; Revicki et al., 2008; Terwee et al., 2007). This may partly explain why several HBA-FAQ outcomes appeared relatively stable between 2024 and 2025. In addition, after the baseline data collection in 2023 and the first follow-up in 2024, the key findings, implications and possible strategies to reduce or manage emerging functional and cognitive vulnerability were communicated to CASS and to some participants. It is therefore possible that increased awareness, community engagement or informal support responses may have helped participants and community partners address some areas of decline before the 2025 follow-up. However, this interpretation should be treated cautiously because these responses were not formally designed, standardised or evaluated as an intervention within the present study. The use of 0 as a response option may also have been less intuitive for some participants, particularly in a community-based survey context where older adults may be more familiar with rating scales beginning at 1 (Bendayan et al., 2019; Menold & Bogner, 2016). Future studies may consider using a more participant-friendly response scale, such as 1–4 with a separate clearly labelled N/A option, or alternative functional assessment tools with greater sensitivity to longitudinal change.

Overall, this study contributes longitudinal evidence showing that functional change, cognitive symptoms and frailty do not necessarily progress in parallel. Functional and cognitive changes appeared earlier, frailty increased later, and depressive symptoms remained stable. This pattern supports a multidimensional approach to healthy ageing assessment in Chinese-speaking older adults, with attention to functional, cognitive, physical and emotional domains over time.

Strengths and limitations

This study has several strengths. First, it used a three-year longitudinal design, allowing changes in functional, cognitive, frailty-related and depressive symptom outcomes to be examined over time rather

than at a single cross-sectional point. Second, the study focused on older Chinese-speaking adults in Australia, a culturally and linguistically diverse population that remains underrepresented in longitudinal ageing research. Third, follow-up completion was high, with most participants contributing data across all three survey waves. This strengthened the reliability of the longitudinal analyses and supported the use of mixed-effects models. Fourth, the study used multiple outcome measures, including the HBA-FAQ, AD8, FRAIL Scale and GDS-5, allowing functional, cognitive, physical and emotional domains of ageing to be examined together. The use of complete-case sensitivity analyses further supported the robustness of the main findings.

Several limitations should also be acknowledged. The sample was recruited through Chinese community organisations in Sydney, which may limit generalisability to older Chinese-speaking adults who are less socially connected, live in other regions, or do not participate in community-based activities. This recruitment approach likely over-represents relatively healthier, more mobile and socially active individuals, and under-represents those with more advanced cognitive impairment, significant mobility limitations, or greater social isolation; as a result, the observed trajectories may represent conservative estimates of decline in the broader population of older Chinese-speaking adults. Participants who remained in the study across three years may also have been healthier or more engaged than those lost to follow-up. The outcome measures were based on self-report or informant-style responses, which may be affected by recall, interpretation of response options, health literacy and cultural factors.

An additional methodological limitation concerns the use of linear mixed-effects models for count-type bounded outcomes (AD8, FRAIL, GDS-5). Models also did not adjust for baseline demographic or health covariates (e.g., age, gender, education, chronic disease burden), which may confound or modify the observed trajectories; the unadjusted approach was chosen to describe overall trajectories rather than identify independent predictors, and adjusted models are recommended for future analyses of this cohort.

A further limitation relates to the HBA-FAQ scoring structure. The response format used a limited 0–3 ordinal scale, which may have reduced sensitivity to subtle longitudinal change and contributed to ceiling or floor effects in some domains. This may partly explain why several HBA-FAQ outcomes appeared relatively stable between 2024 and 2025, despite evidence of functional and cognitive vulnerability. The use of 0 as a response option may also have been less intuitive for some older participants, who may be more familiar with rating scales beginning at 1. Although the HBA-FAQ is useful for assessing functional changes relevant to mild cognitive impairment, its sensitivity for detecting small changes over repeated longitudinal assessments may require further evaluation. Future studies may consider adapting the response structure, such as using a 1–4, 1–5 or 1–7 scale with a separate clearly labelled N/A option, to improve participant understanding and reduce potential ceiling or floor effects. Further validation of the HBA-FAQ scoring approach in Chinese-speaking and other culturally and linguistically diverse older populations is also warranted.

Finally, although the study identified changes across three years, the observational design does not allow causal conclusions. Future research with larger and more diverse samples, longer follow-up periods, and additional clinical or objective measures would help clarify the mechanisms linking functional change, cognitive symptoms and later frailty.

Practice and public health implications

The findings have important implications for practice and public health. Functional change and cognitive symptoms increased earlier in the follow-up period, while frailty increased later. This suggests that routine monitoring of everyday functioning and cognitive symptoms may help identify emerging vulnerability before more visible frailty-related decline occurs. Community health, primary care and aged care providers should therefore consider assessing functional change, cognition and frailty together, rather than treating these as separate ageing-related concerns.

For older Chinese-speaking adults, culturally and linguistically appropriate assessment is particularly important. Language barriers, limited familiarity with health and aged care systems, stigma around cognitive decline and mental health, and reliance on family or community networks may delay help-seeking. Community-based screening through trusted Chinese-speaking organisations may provide an accessible pathway for early identification, health education and referral. Brief tools such as the HBA-FAQ, AD8, FRAIL Scale and GDS-5 may be useful in community settings when administered with appropriate language support and culturally sensitive explanation.

The domain-level findings also suggest practical areas for intervention. Increasing difficulty with household tasks, everyday technology, social/work functioning and behaviour change may signal early functional vulnerability. Support programs could include culturally tailored education on cognitive ageing, practical strategies for maintaining independence, digital literacy support, social participation activities and referral pathways for cognitive, frailty and aged care assessment. Because everyday technology is increasingly linked to healthcare access, service navigation and social connection, digital inclusion should be considered part of healthy ageing support for Chinese-speaking older adults.

At a public health level, these findings support the need for longitudinal monitoring of ageing-related vulnerability in culturally and linguistically diverse communities. Health equity approaches should ensure that older migrants are not only included in ageing and dementia research, but also have access to culturally responsive prevention, screening and early intervention services. Partnerships between researchers, community organisations, primary care, aged care providers and multicultural health services may help translate longitudinal findings into practical support for older Chinese-speaking adults and their families.

Conclusion

This three-year longitudinal study found distinct patterns of change in functional, cognitive and frailty-related outcomes among older Chinese-speaking adults. Functional change and cognitive symptoms

increased from baseline to 2024 and then remained relatively stable in 2025, while frailty increased later in the follow-up period. Depressive symptoms remained stable across all three years. These findings suggest that functional and cognitive changes may emerge earlier than measurable increases in frailty, highlighting the importance of longitudinal monitoring in culturally and linguistically diverse older populations. Routine assessment of functional change, cognitive symptoms and frailty may support earlier identification of emerging vulnerability and inform timely, culturally responsive ageing and dementia-related care.

Abbreviations

AD8
Eight-item Ascertain Dementia questionnaire
CALD
Culturally and linguistically diverse
CI
Confidence interval
EMM
Estimated marginal mean
FRAIL
Fatigue, Resistance, Ambulation, Illness and Loss of weight scale
GDS-5
Five-item Geriatric Depression Scale
HBA-FAQ
Healthy Brain Ageing–Functional Assessment Questionnaire
HREC
Human Research Ethics Committee
LMM
Linear mixed-effects model
N/A
Not applicable
SD
Standard deviation
SPSS
Statistical Package for the Social Sciences
STROBE
Strengthening the Reporting of Observational Studies in Epidemiology

Declarations

Ethics approval for this study was obtained from the University Human Research Ethics Committee. All participants provided informed consent to participate in the study prior to data collection.

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