

Optimising dementia screening in community-dwelling older adults: A rapid review of brief diagnostic tools in Singapore

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ABSTRACT

Introduction: Timely detection of dementia enables early access to dementia-specific care services and interventions. Various stakeholders brought together to refine Singapore's dementia care strategy identified a lack of a standardised cognitive screening tool and the absence of a comparative review of existing tools. We hence conducted a rapid review to evaluate the diagnostic performance of brief cognitive screening tools in identifying possible dementia among community-dwelling older adults in Singapore.

Method: Brief cognitive screening tools were defined as interviews or tests administered in ≤ 5 minutes. Studies performed in Singapore on older adults ≥ 60 years, which used locally-validated comparators and reported outcomes of clinician-diagnosed dementia were included. Rapid review methodology was used in study screening and selection. Quality Assessment of Diagnostic Accuracy Studies version 2 tool was used for risk-of-bias assessment. A negative likelihood ratio (LR-) of ≤ 0.2 was defined a priori as having a moderate effect in shifting post-test probability.

Results: Fourteen studies were included in qualitative synthesis: 3 studies evaluated self-/informant-based tools only, 4 evaluated performance-based measures only and 7 evaluated combination approaches. Eight-item Informant Interview to Differentiate Aging and Dementia (iAD8) was the most studied self-/informant-based tool. One study found informant AD8 (iAD8) superior to self-rated AD8. Another study found iAD8 superior to Mini-Mental State Examination. Among performance-based measures, Abbreviated Mental Test, Visual Cognitive Assessment Test-Short form version 1 (VCAT-S1), VCAT-S2 and Mini-Cog had LR- < 0.2 . Minimal improvement of combination approaches compared to iAD8 alone was demonstrated.

Conclusion: Our review suggests the limited utility of dementia screening in communities with low dementia prevalence and supports a case-finding approach instead. With a reliable informant, iAD8 alone has sufficient discriminant ability. Further research is needed to specifically assess the diagnostic ability of performance-based tools in community settings.

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CLINICAL IMPACT

What is New

- Subjective tools (e.g. self-reported or informant-rated) are recommended over performance-based tools; among these iAD8 demonstrated superior diagnostic ability compared to sAD8.
- In the presence of a reliable informant, iAD8 alone had sufficient discriminant ability, with limited additional benefit when used in conjunction with other performance-based tools.

Clinical Implication

- Based on this review, a case-finding approach to identify possible dementia in at-risk populations is recommended, rather than a community-wide or non-targeted population screening; this is also aligned with international screening guidelines.

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INTRODUCTION

Persons living with dementia experience chronic and progressive cognitive decline in 1 or more cognitive domains, affecting their everyday activities.¹ Globally, the number of persons living with dementia is expected to rise from 55 million in 2019 to 139 million in 2050, with an estimated two-thirds in lower- and middle-income countries.² In Singapore, based on a 2015 nationwide study, dementia prevalence was found to be around 10%, which translates to approximately 86,000 adults aged 60 years and above.³ The number of individuals affected is projected to increase to 130,000 by 2030. Dementia is associated with significant societal costs, resulting from a combination of greater healthcare utilisation and an increased need for both formal and informal caregivers. In 2013, the total cost of dementia care in Singapore was estimated to be SGD 532 million, with an annual cost per person of SGD 10,245.⁴

The 2017 Lancet Commission for dementia prevention highlighted the importance of timely detection of dementia among older adults with cognitive concerns, enabling early access to dementia-specific care services and interventions.⁵ Multidisciplinary interventions, such as dementia counselling and education, cognitive engagement strategies, and medications, can help reduce patient and caregiver anxiety, progression of cognitive and neuropsychiatric symptoms, as well as facilitate long-term care planning, thereby reducing the occurrence of dementia-related crises. A study looking at excess dementia-related healthcare costs in Sweden found 13–25% higher healthcare costs, as early as a decade before diagnosis, peaking at the year of diagnosis. The healthcare costs subsequently reduced and became comparable to the population without dementia—supporting observations of preventable inpatient and post-acute services utilisation in the pre-dementia diagnosis period.⁶

The World Health Organization's Global Action Plan on the Public Health Response to Dementia highlighted dementia diagnosis, awareness, treatment and support as key action areas.⁷ In line with this, Singapore announced the 2023 Action Plan for Successful Ageing, which highlighted managing dementia as a priority area in providing good care for older adults through (1) prevention and awareness; (2) early identification and diagnosis; (3) empowering persons living with dementia to age well in the community; and by (4) supporting dementia caregivers.⁸ An integral component of this plan is the early identification of community-dwelling older adults at risk of dementia, so that appropriate assessments and interventions may be provided to these individuals.

As part of national efforts to enhance dementia management, various healthcare and community stakeholders collaborated to refine Singapore's dementia care strategy. Two key issues were identified: first, the absence of a standardised cognitive screening tool used in Singapore to identify older adults at risk of dementia; and second, the lack of a comparative review of the performance of existing tools across different settings (such as community versus primary care). Prior to this, only 1 systematic review of cognitive screening tools performed in Asia was published in 2016. This study included 2 studies carried out in Singapore based on the Mini-Mental State Examination (MMSE).⁹ However, to date, there has not been an in-depth review of the various cognitive tools used to identify possible dementia in the Singapore population. This rapid review was hence conducted with the aim of evaluating the diagnostic performance of brief cognitive screening tools used to identify possible dementia among community-dwelling older adults in Singapore, with additional analysis of their performance in different settings.

METHOD

We used a rapid review methodology defined by Cochrane Rapid review guidelines.¹⁰ Rapid reviews adopt systematic review methods and processes in a streamlined manner, allowing for accelerated yet rigorous knowledge synthesis of available literature.¹⁰ Rapid reviews are suitable methodologies of literature review for requests for timely evidence for decision-making purposes to address urgent and emergent health issues and questions deemed of high priority. Given the need to provide relevant evidence to the dementia strategy workgroup in a timely manner, the rapid review was an appropriate methodology to address the clinical question posed by the workgroup.

Search strategy

We adapted the Joanna Briggs Institute (JBI) 3-step search strategy,¹¹ with an initial limited search conducted in MEDLINE by 2 reviewers (authors JPL and SL). A list of relevant articles was identified, and an analysis of the text word and Medical Subject Headings terms was performed to identify relevant search terms. The search strategy was further refined to identify studies conducted in community-based settings (such as adult day care centres and primary health clinics) with guidance from the librarian. Table 1 shows a summary of the search terms.

In the second step of the search, our full search strategy was applied across the databases: MEDLINE, Cochrane Collaborative Library, PsycInfo and Embase for published articles up till 12 March 2023

(Supplementary Tables S1A-D). The cut-off date of 12 March 2023 was set to meet the deadline provided by our stakeholders. Additional filters were applied to limit the studies to those conducted on the Singapore population and published in the English language. In the final step, reference lists of the included studies were also searched, as recommended by the JBI strategy, but yielded no additional results. We excluded unpublished studies, conference abstracts, non-English publications and grey literature. In preparation for the current manuscript, we performed an updated search for newly published studies from 13 March 2023 to 15 April 2024 using the same strategy.

Eligibility criteria

We defined cognitive screening tools as interviews conducted with patients or their caregivers, questionnaires or performance-based tests used to identify individuals at risk of cognitive impairment. A brief cognitive screening tool is one that can be administered in 5 minutes or less, reflecting its feasibility to be used by community providers. We included studies that (1) were performed on older adults aged 60 years and above; (2) used locally-validated comparators such as the MMSE or Montreal Cognitive Assessment (MoCA); (3) evaluated outcomes of clinician-diagnosed dementia; (4) were conducted in the Singapore community, primary care or outpatient clinic settings; and (5) were quantitative studies. Studies conducted in inpatient and long-term care settings were excluded. We also did not include studies that exclusively recruited patients attending tertiary memory clinics without recruiting controls from the community.

Study screening and selection

Title and abstract screening were independently completed by 2 reviewers (JPL and SL). In line with the rapid review framework, the first 20% of articles were screened by both reviewers. Conflicts were resolved through consensus discussion, with

adjudication by a third reviewer (WSL) if needed. The remaining titles and abstracts were screened by the first reviewer, with all excluded articles cross-checked by the second reviewer and conflicts resolved through consensus discussion, shown in the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) diagram (Fig. 1). A similar approach was adopted for the full-text screening phase, with the first 20% of articles being dually-screened by both reviewers and conflicts were resolved before the remaining articles were singly-screened. All excluded articles were cross-checked by the second reviewer, with involvement of a third reviewer (WSL) if needed. This 2-stage screening process was managed in Covidence (Veritas Health Innovation, Melbourne, Australia) an online systematic review software.¹²

Risk-of-bias assessment

We performed a risk-of-bias and applicability assessment for all included full-text articles using the Quality Assessment of Diagnostic Accuracy Studies version 2 (QUADAS-2) tool. This is a validated tool for assessing quality of primary diagnostic accuracy studies. The domains of “patient selection”, “index test”, “reference standard” and “flow and timing” were rated for risk of bias and applicability to our research question. The ratings were guided by signalling questions of the QUADAS-2 tool. Quality assessment was performed independently by 2 reviewers (JPL and SL) for all included articles and discrepancies were resolved through discussion.

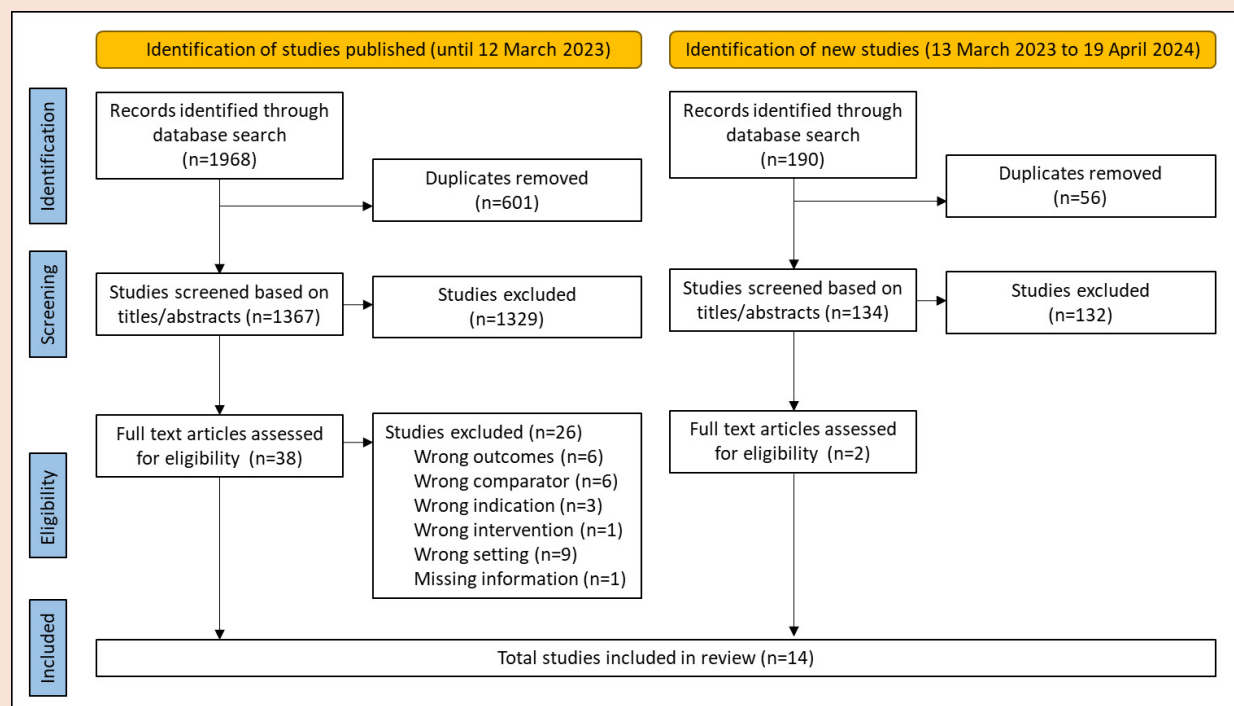
Data extraction

We created a standardised data extraction form comprising study characteristics and indicators of diagnostic accuracy. The following variables on study characteristics were extracted: sample size, gender representation, study setting, study design, index test, comparator instruments, reference standard used and dementia prevalence in the study population. Variables of diagnostic accuracy

Table 1. Summary of search terms.

Keywords	
Population	Older adult(s), older people, senior(s)
Intervention	Cognitive screen, cognitive testing, geriatric assessment/methods, mental status and dementia tests, neuropsychological tests/standards, rapid cognitive screen
Outcome	Alzheimer disease/diagnosis, cognition disorders/diagnosis, cognitive impairment, dementia, early diagnosis, executive function, mild cognitive impairment
Setting	Adult day care centers, ambulatory care, clinic visit, community health nursing, community mental health services, health services for the aged, home care services, outpatient care, primary healthcare, senior centers

Fig. 1. PRISMA flow diagram.



PRISMA: Preferred Reporting Items for Systematic reviews and Meta-Analyses

of the cognitive screening tools included accuracy (area under the curve [AUC]); cut-offs; sensitivity (Sn) and specificity (Sp) at various cut-off points; negative and positive likelihood ratios; as well as negative and positive predictive values. Data extraction was performed by the first reviewer and cross-checked by the second reviewer.

Data synthesis

Data from all the included studies were extracted and presented in the form of frequencies and percentages. The index tests were grouped in accordance to the type of assessment (i.e. self/informant report versus performance-based tests, or a combination of these modalities). Given the varying prevalence of dementia across different settings, the data were further stratified by study setting. Diagnostic accuracy information was presented as percentages with 95% confidence interval (CI). When specific values were not explicitly stated, we calculated likelihood ratios and predictive values using the data provided in the studies. In view of marked heterogeneity in the study setting, index tests and reference standards, pooled analysis was not possible.

RESULTS

In the initial phase, we identified 1968 studies using keyword search, of which 601 were duplicates and an additional 1329 studies were excluded at

the title and abstract screening stage. Thirty-eight full-text articles were assessed for eligibility, and 12 studies were included in the qualitative synthesis. In the updated search, we identified another 190 studies, of which 56 were duplicates. Out of the remaining 134 studies, 132 were excluded after screening of their titles and abstracts. Two remaining studies were assessed for eligibility at the full-text assessment stage and included. Thus, a total of 14 studies were included in the final qualitative synthesis, outlined in the PRISMA diagram (Fig. 1).

Quality assessment

Most studies (8 of 14 studies) were rated as having unclear/high risk of bias in terms of patient selection, largely due to a case-control study design (Table 2, Supplementary Table S2). Only 7 studies had a low risk of bias in the flow and timing of index test and reference standard test. Most studies (12 of 14) had low risk of bias in terms of the reference standard used in the study. In terms of applicability, concerns arose primarily from patient selection in the studies—a result of the unclear/high risk of bias status in these studies.

Study characteristics

Of the 14 studies, 5 were case-control studies.¹³⁻¹⁷ Cases were patients with dementia recruited from memory clinics, and controls were participants

Table 2. Quality of assessment (QUADAS-2).

Author, year	Risk of bias				Concerns regarding applicability		
	Patient selection	Index test	Reference standard	Flow and timing	Patient selection	Index test	Reference standard
Chan et al. 2016 ¹⁸	Unclear	Low	Low	High	Low	Low	Low
Chan et al. 2016 ¹⁹	Unclear	Low	Low	High	Low	Low	Low
Chong et al. 2006 ²⁴	Low	Low	Low	Low	Low	Low	Low
Dong et al. 2013 ¹³	High	Low	Low	Low	High	Low	Low
Kan et al. 2019 ²³	Unclear	Low	Low	Low	Low	Low	Low
Koh et al. 2020 ¹⁶	High	High	Low	Unclear	High	Low	Low
Li et al. 2006 ²¹	Low	Low	Low	High	Low	Low	Low
Pang et al. 2022 ²²	Low	Low	Unclear	Low	Low	Low	Low
Pang et al. 2023 ²⁶	Low	Low	Low	High	Low	Low	Low
Shaik et al. 2016 ²⁰	Low	Low	Low	Low	Low	Low	Low
Sahadevan et al. 2000 ¹⁴	High	Low	Low	High	High	Low	Low
Tew et al. 2015 ¹⁷	High	Low	Low	High	High	Low	Low
Venketasubramanian. 2024 ²⁵	Low	Low	Low	Low	Low	Low	Low
Yap et al. 2007 ¹⁵	High	High	Low	High	Low	High	Low

Superscript numbers: refer to REFERENCES

QUADAS-2: Quality Assessment of Diagnostic Accuracy Studies version 2

recruited from community settings. Four were studies of combined cohorts from primary care settings^{18–20} and combined cohorts of patients in outpatient neuroscience clinics and community settings.²¹ The remaining 5 studies were community-based studies (Supplementary Table S3).^{22–26} Pooled analysis of the results was not possible due to the heterogeneity of the included studies in terms of study setting, study design and population characteristics, even with grouping according to the brief cognitive tool evaluated.

Self-reported/informant-based measures only

Three studies solely evaluated self-reported or informant-based tools (Table 3).^{13,19,22} The most studied tool used was the Eight-item Informant Interview to Differentiate Aging and Dementia (AD8).²⁷ A study in primary care settings found that informant AD8 (iAD8) was superior to the MMSE in accuracy: AUC 0.97 (95% CI 0.95–0.99) versus AUC 0.92 (95% CI 0.88–0.97, $P=0.047$) and equivalent to MoCA: AUC 0.94 (95% CI 0.92–0.97, $P=0.13$).¹⁹ iAD8 was also demonstrated to have superior diagnostic accuracy compared to self-rated AD8 (sAD8) in a study performed in outpatient clinic settings. At a cut-off point of 2 and above, iAD8 had a sensitivity of 93.0%,

specificity of 87.0% and positive likelihood ratio (LR+) of 6.85 (95% CI 3.03–15.49), compared with sensitivity of 59.0%, specificity of 65.0% and LR+ 1.69 (95% CI 1.08–2.65) for sAD8.¹³

Another study compared single-item questions of subjective complaints from questionnaires of the 10th item on the self-rated Geriatric Depression Scale (GDS-10), 8th item of sAD8 (sAD8-8) and 8th item of iAD8 (iAD8-8).²² Of these, iAD8-8 had the best diagnostic performance (Sn 69.2%, Sp 83.2%, LR+ 4.12) compared to sAD8-8 (Sn 41.7, Sp 76.5, LR+1.77) and GDS-10 (Sn 40.9%, Sp 82.9%, LR+ 2.4).

Performance-based measures only

There were 4 studies evaluating performance-based measures only; 3 used a case-control methodology whereby cases were recruited from specialist outpatient memory clinics, and controls were recruited from community settings such as community clubs and door-to-door surveys.^{14–16} Not surprisingly, the dementia prevalence in these studies was high, ranging between 38.6–53.0%. The Abbreviated Mental Test (AMT) had good diagnostic accuracy at age and education-stratified cut-offs with sensitivities ranging 80–97% and specificities 83–100% (Table 3).

Table 3. Studies of self-rated/informant-based measures only and performance-based measures only.

Author, year	Study design; study setting	Dementia prevalence (%)	Tool (language); cut-off point	Sensitivity (%)	Specificity (%)	Accuracy (%)	Negative likelihood ratio	Positive likelihood ratio
Self-rated/informant-based measures only								
Chan et al. 2015 ¹⁹	Cross-sectional; primary care	14.2	Informant AD8 (E/C/M); 3/4	91.0	91.0	91.0	0.10	10.11
Dong et al. 2013 ¹³	Case-control; memory clinic (cases), community (control)	53.0	Informant AD8 (E/C/M); ≥2	93.0	87.0	91.8	0.09	6.85
			Self-rated AD8 (E/C/M); ≥2	59.0	65.0	60.0	0.63	1.69
Pang et al. 2022 ²²	Cohort; community	4.8	GDS-10; yes/no	40.9	82.9	80.0	0.71	2.40
			Informant AD8-8; yes/no	69.2	83.2	82.5	0.37	4.12
			Self-rated AD8-8; yes/no	41.7	76.5	75.0	0.60	1.77
Performance-based measures only								
Koh et al. 2020 ¹⁶	Case-control; memory clinic (cases), community (control)	53.0	VCAT-S1 (LN); <12	86.0	83.0	92.0	0.17	5.06
Sahadevan et al. 2000 ¹⁴	Case-control; memory clinic (cases), community (control)	38.6	VCAT-S2 (LN); <10	76.0	90.0	92.0	0.27	7.60
			AMT (E/C); 60–74 years old; 0–6 yrs of education: 7/8	97.0	83.0	-	0.036	5.71
			60–74 years old; ≥7 years of education: 8/9	80.0	91.0	-	0.22	8.88
			≥75 years old; 0–6 years of education: 5/6	91.0	100	-	0.1	-
			≥75 years old; ≥7 years of education: 8/9	85.0	100	-	0.15	-
Yap et al. 2007 ¹⁵	Case-control; memory clinic (cases), community (control)	49.3	CLOX1 (LN); 0–6 years of education: 10	78.6	64.0	78.0	0.33	2.18
			>6 years of education: 11	88.2	68.4	88.0	0.17	2.79
			Overall: 10	75.3	76.0	84.0	0.33	3.14
			CLOX2 (LN); 0–6 years of education: 12	76.8	64.9	81.0	0.36	2.19
			>6 years of education: 13	87.5	81.6	91.0	0.15	4.76
Venketasubramanian 2024 ²⁵	Cohort (2-phase study); community	22.8	Overall: 12	75.0	80.0	85.0	0.31	3.75
			ECAQ (E/C/M/T); ≤5	78.0	95.5	95.0	0.23	17.3

AD8: Eight-Item Informant Interview to Differentiate Aging and Dementia; AD8-8: 8th question of AD8; AMT: Abbreviated Mental Test; CLOX: clock drawing task; E/C/M/T: English/Chinese/Malay/Tamil; ECAQ: Elderly Cognitive Assessment Questionnaire; GDS-10: 10th item on the Geriatric Depression Scale; LN: language neutral; VCAT-S: Visual Cognitive Assessment Test-short form
Superscript numbers: refer to REFERENCES

Another study evaluated the diagnostic performance of the clock drawing task (CLOX), using 2 methods of performing the test (CLOX1 and CLOX2).¹⁵ The diagnostic accuracy of CLOX1 and CLOX2 were comparable, albeit at different cut-off points of 10 and 12, respectively (CLOX1: Sn 75.3%, Sp 76.0%, LR+3.1; CLOX2: Sn 75.0%, Sp 80.0%, LR+ 3.8).

The third study evaluated the Visual Cognitive Assessment Test short-form (VCAT-S) which consisted of 5 items from the original VCAT developed in Singapore.¹⁶ Two scoring systems VCAT-S1 and VCAT-S2 were studied. VCAT-S1 and VCAT-S2 demonstrated high diagnostic accuracy of 92%, Sn 86–90%, Sp 80–81%, and LR+ 4.53, albeit against a high prevalence of dementia at 53% in the study population.

Only 1 study evaluated the Elderly Cognitive Assessment Questionnaire (ECAQ).²⁵ This community study used a 2-phase approach whereby participants were first screened with a modified World Health Organization screening tool for neurological disorders. All who screened positive and a subset who screened negative were included in the second phase. This strategy, akin to a case-finding approach, resulted in a slightly high dementia prevalence of 22.8% for a community study. The ECAQ demonstrated a high diagnostic accuracy of 95%, specificity of 95.5%, sensitivity of 78.0% and high LR+17.3.

Combination approaches

Six studies looked at combination approaches where combinations of tools were used for identification of dementia (Table 4). Three studies assessed iAD8 in conjunction with performance-based tools,^{17,18,23} and 1 study evaluated a risk score used together with iAD8.²⁰ A community-based study examined performance-based tools of either 5-min MoCA or Mini-Cog in conjunction with iAD8.²³ The study evaluated 2 combination approaches: a conjunctive approach that required both iAD8 and the additional test results to be positive versus a compensatory approach that only required 1 positive test result. The results demonstrated minimal improvement with combination approaches (whether conjunctive or compensatory) compared to iAD8 on its own (accuracy: iAD8 0.89; iAD8+5-min MoCA 0.82; iAD8/5-min MoCA 0.87; iAD8+Mini-Cog 0.84; iAD8/Mini-Cog 0.79).

Similarly, there was limited additional benefit of combination approaches of iAD8 with selected elements of the MMSE (recall question, recall and copy question)¹⁷ and combination of National Institute of Neurological Disorders and Stroke-Canadian Stroke Network (NINDS-CSN) 5-minute

protocol¹⁸ seen in 2 other studies in the outpatient memory clinic and primary care setting, respectively. The diagnostic accuracy for iAD8 only (AUC 0.93) was comparable to iAD8+recall (AUC 0.94) and iAD8+recall+copy (0.95).¹⁷ Compared with iAD8 alone (accuracy 93.0%), conjunctive and compensatory approach for iAD8 with NINDS-CSN 5 min had lower diagnostic accuracy of 89.4% and 82.0%, respectively.¹⁸

Two studies evaluated combination approaches of progressive forgetfulness (PF) as the self-rated tool and AMT as the performance-based tool.^{24,26} In both studies, PF and AMT were performed for all participants in the first phase, and those who scored positive for either were included in the second phase for assessment of dementia via clinical and neuropsychological evaluations. In Chong et al.'s study, the conjunctive approach for positive PF and AMT (PF+ and AMT+) had the highest LR+ (5.31);²⁴ other diagnostic indices in this study were not reported. Similarly, the highest LR+ (13.37) and diagnostic accuracy (88.4%) were found for PF+ and AMT+ combination in Pang et al.'s study.²⁶

DISCUSSION

This rapid review provides a comprehensive overview of the cognitive tools used to identify possible dementia among community-dwelling older adults in Singapore. Among the 12 included studies, only 3 studies were fully community-based with case prevalence corresponding to population studies.²²⁻²⁴ Studies evaluating cognitive tools performed in community cohorts reported accuracy ranging 75–92%, negative predictive value (NPV) of 96.8–99% and low positive predictive value (PPV) of 7.2–57%. In primary care settings, studies reported higher accuracy between 81–97%, NPV 91–98% and much higher PPV of 63–92%.

Our review suggests that dementia screening has limited utility in communities with low dementia prevalence, given the low PPV of the current tools in such settings. Instead, a case-finding approach is recommended, whereby at-risk populations such as patients with chronic diseases or subjective memory complaints attending primary care services, are screened intentionally for dementia. This is consistent with screening guidelines in the UK and US.²⁸ Australia's clinical guidelines for dementia do not recommend population screening, and instead highlight vigilance for symptoms of cognitive impairment in older adults for referral to specialists of dementia for further detailed evaluation.³⁰ A recent systematic review commissioned by the US Preventive Services Task Force found no empirical evidence that screening the general population

Table 4. Studies of self-rated/informant-based measures and performance-based measures in combination.

Author, year	Study design; Study setting	Dementia prevalence (%)	Tool (language); cut-off point	Sensitivity (%)	Specificity (%)	Accuracy (%)	Negative likelihood ratio	Positive likelihood ratio
Chan et al. 2016 ¹⁸	Cross-sectional study; primary care	21.4	iAD8; ≥2	85.0	86.8	86.2	0.17	6.44
			NINDS-CSN 5-min: 6/7	81.7	86.8	85.2	0.21	6.19
			Compensatory iAD8+NINDS-CSN 5-min; 2/3 and/or 6/7	93.3	76.7	82.0	0.09	4.00
			Conjunctive iAD8+NINDS-CSN 5-min; 2/3 and 6/7	73.3	96.9	89.4	0.28	23.6
Chong et al. 2006 ²⁴	Cohort study (2 phase); community	14.0	PF; yes/no	95.7	45.1	-	0.10	1.74
			AMT (overall);	86.9	71.4	-	0.20	3.04
			Young-old (60–74 yrs):	75.0	80.4	-	0.19	5.10
			AMT 7/8 (0–6 years education)	93.3	34.6	-	0.19	1.43
			AMT 8/9 (>6 years education)					
			Old-old (≥75 years):					
			AMT 5/6 (0–6 years education)					
			AMT 8/9(>6 years education)					
			PF+ and AMT +	-	-	-	-	5.31
			PF- and AMT +	-	-	-	-	0.31
Kan et al. 2019 ²³	Cohort study; community	5.5	PF+ and AMT -	-	-	-	-	0.35
			iAD8; ≥3	76.0	94.0	89.0	0.26	12.67
			5-min MoCA; ≤5	81.0	90.0	92.0	0.21	8.10
			Mini-Cog; ≤2	93.0	67.0	89.0	0.10	2.82
			Compensatory iAD8+5-min MoCA; ≥3/≤5	91.0	83.0	87.0	0.11	5.35
			Conjunctive iAD8+5-min MoCA; ≥3, ≤5	67.0	97.0	82.0	0.34	22.33
			Compensatory iAD8+Mini-Cog; ≥3/≤2	95.0	63.0	79.0	0.08	2.57
			Conjunctive iAD8+Mini-Cog; ≥3, ≤2	74.0	95.0	84.0	0.27	14.80

Table 4. Studies of self-rated/informant-based measures and performance-based measures in combination. (Cont'd)

Author, year	Study design; Study setting	Dementia prevalence (%)	Tool (language); cut-off point	Sensitivity (%)	Specificity (%)	Accuracy (%)	Negative likelihood ratio	Positive likelihood ratio
Li et al. 2006 ²¹	Combined cohorts; neuroscience clinic patients, community cohort	13.2	IRMP (E/C); yes/no	85.7	80.7	83.2	0.18	4.44
			4IADL (E/C); ≤8	78.6	67	84.7	0.32	2.38
			IRMP+4IADL(E/C); ≤ 7	85.7	85.7	91.6	0.17	5.79
Pang et al. 2023 ²⁶	Cohort study (2 phase); community	4.9	PF+AMT; PT: yes/no, AMT 6/7 (0–6 years education) AMT 8/9 (>6 years education) PF+ and AMT+	82.9	93.8	88.4	0.18	13.37
			PF- and AMT+	71.0	66.7	71.4	0.47	2.33
			TRS; ≥4	70.0	77.0	81.0	-0.39	3.05
Shaik et al. 2016 ²⁰	Cohort study (2 phase); primary care	54.8	TRS+AD8 (E/C/M)	-	-	-	-	-
			iAD8 (E/C); 5/6	90.7	84.3	92.0	0.11	5.78
			iAD8+Recall (E/C); 7/8	88.4	84.9	94.0	0.14	5.85
Tew et al. 2015 ¹⁷	Case-control; memory clinic (cases), community (age- matched control)	64.9	iAD8+Recall+Copy (E/C); 8/9	87.2	88.1	95.0	0.15	7.33

4IADL: brief Instrumental Activities of Daily Living scale; 5-min MoCA: 5-minute Montreal Cognitive Assessment; AD8: Eight-Item Informant Interview to Differentiate Aging and Dementia;
AMT: Abbreviated Mental Test; E/C/M/T: English/Chinese/Malay/Tamil; iAD8: informant AD8; IRMP: Informant Report of a single question on Memory Decline; NINDS-CSN 5-min: National Institute of
Neurological Disorders and Stroke-Canadian Stroke Network 5-minute protocol; PF: progressive forgetfulness; TRS: total risk score
Superscript numbers: refer to REFERENCES

with neither memory concerns nor risk factors for dementia improves decision-making for patients with the earlier detection of cognitive impairment.²⁹ Another paper evaluating national dementia policies across 7 countries around the globe with active national dementia plans (China, Germany, Japan, South Korea, Sweden, UK and US) found that only South Korea had policies to support population screening for brain health.³¹ Studies on a screening programme's cost-effectiveness were inconclusive—a South Korean study reported a cost per quality-adjusted life-year gained ranging from USD 24,150 to 35,661.³²

Of the tools included, the AD8 was the most studied brief cognitive screening instrument. We recommend iAD8 over sAD8 in view of superior diagnostic performance. The iAD8 also retained good discriminatory ability when administered as a single test with no discernible benefit using combination approaches. The additional time needed to perform both the iAD8 and a performance-based test did not justify the marginal improvement of negative likelihood ratio in most of the combination approaches (Table 4). This finding was corroborated by studies performed in Taiwan³³ and US.³⁴ The use of AD8 was promoted in Taiwan with validated Chinese versions of AD8 for both sAD8 and iAD8. The accuracy for sAD8 was 59.0% while that of iAD8 was 77%.³³ Similarly, a study performed in US found that iAD8 was inversely related to the patient's MoCA scores while sAD8 had no relation with MoCA scores, suggesting that iAD8 was a more useful indicator of the patients' cognitive ability.³⁴ However, the generalisability of these results to the general population would need to be considered. Of note, outpatient clinics (particularly the specialist memory clinics) may represent a unique context whereby the accompanying informant would likely be more concerned about the patient's cognition and thus provide a more reliable corroborative input to complete the iAD8 compared to informants encountered in community settings.

Thus, despite the good discriminant ability of iAD8, there remains a role for performance-based tools especially in situations where there is either no next-of-kin or reliable informant available. In our review, many of the performance-based studies recruited cases from the memory clinic settings. Diagnostic performance of tools employed in specialised care settings were likely to be inflated due to spectrum bias, high case prevalence, and weaker study design (i.e. case-control). In addition, the high dementia prevalence in these studies would have affected the PPVs and NPVs. To minimise the impact of the wide range of dementia prevalence,

we compared the LR- between the tools. An LR- expresses how many times less likely a normal test result is to be expected in patients with the condition as compared to those without.³⁵ Hence, to evaluate how informative the test is in ruling out dementia, a smaller LR- would indicate a more informative test. An LR- of 0.2 and below was determined by the study team a priori as having a moderate effect in shifting the post-test probability. The performance-based tools fulfilling this threshold were the AMT, VCAT-S1, VCAT-S2 and Mini-Cog (Tables 3 and 4). The 5-min MOCA (LR- 0.21) and NINDS-CSN 5-min (LR- 0.21) had an LR- trending close to 0.2.

Among the performance-based tools, only AMT had more than 1 study done in either the community or outpatient clinic settings. Sahadevan et al. (2000) included cases from an outpatient memory clinic and evaluated the diagnostic performance of AMT against age and education-specific cut-offs.¹⁴ For the 60–74 years age group, the cut-offs were 7 for those with 0–6 years of education, and 8 for those with more than 6 years of education. For older adults 75 years and above, the cut-offs were 5 and 8, respectively. In contrast, Chong et al. (2006)²⁴ involved a community-based study which evaluated use of AMT in a sequential approach, where the AMT would only be administered if participants reported progressive forgetfulness. Both studies reported similar AMT cut-offs with comparable sensitivity for the 75 years and older age group (Sahadevan et al. 85–91%, Chong et al. 93.3%), but lower sensitivity in those aged 60–74 years (Sahadevan et al. 80–97%, Chong et al. 75.0%). The findings from Singapore studies on AMT's diagnostic performance were comparable to results from a systematic review performed for the US Preventive Services Task Force on cognitive diagnostic tools (AMT: Sn 42–100%; Sp 83–95.4%).³⁶

At present, AMT is one of the most widely used tools in community settings to screen older adults for cognitive impairment in Singapore. Although the AMT is well-validated in the Singapore population, there are concerns of ceiling effects of AMT among participants of higher education levels. In recent years, there has been increasing interest to employ other performance-based tools, whether in conjunction with or in lieu of the AMT. Our review highlights the need for more community-based studies on other performance-based cognitive screening tools to evaluate the effect of age and education on cut-off scores and diagnostic performance. Other factors that would influence implementation of a new cognitive screening tool would include considerations pertaining to resources (e.g. extent of training and time required

for administration of the tool), context (e.g. validation of different language versions) and clinical applicability (e.g. ease of interpretation of the results).

Our rapid review is unique in including studies of informant-based cognitive tools in the analysis, reflecting the contextual considerations pertinent to practices in community and primary care in Singapore. Published systematic reviews of brief cognitive tools used in Latin America,²⁹ Chinese-speaking regions³⁰ and globally,²⁸ mainly evaluated performed-based tools or single domains of neuropsychological batteries. The time cut-offs for defining a brief cognitive assessment tool were higher as well, ranging 15–20 minutes.^{37–39} In a systematic review of brief cognitive tools used in Latin America, MoCA was found to be the most widely used tool.³⁸ However, the authors noted a significant impact of education level on the diagnostic accuracy of MoCA. Another systematic review and meta-analysis of brief cognitive tools performed in Chinese-speaking populations found acceptable validity of MoCA and MMSE (Sn and Sp >75%).³⁹ However, the meta-analysis results found the best-validated tool to be Addenbrooke's Cognitive Examination (Sn 93.5% and Sp 85.6%).

The limitations of our rapid review included the relatively low number of local studies identified, especially in the community and primary care settings, and the paucity of direct comparison studies for performance-based tools. In addition, we only included local studies published in the English language—this may have potentially missed out validation studies of cognitive diagnostic tools published in the non-English language, although this is extremely unlikely in the Singapore context where English is the lingua franca. In addition, many of the included studies had conducted the cognitive assessments in the major languages spoken in Singapore, allowing for validation of these tools for the non-English speaking local population. We also acknowledge the risk of publication bias of our results as we had limited our search strategy to only published literature in indexed databases and excluded grey literature and unpublished studies.

CONCLUSION

This study is, to our knowledge, the first in-depth and comprehensive review that evaluates the diagnostic performance of brief cognitive screening tools used to identify possible dementia among community-dwelling older adults in Singapore. This review is especially timely considering the rising dementia prevalence consistent with worldwide

trends, and the push towards preventive health and early identification of chronic diseases. The results from this rapid review will help to shape policy decisions on the dementia strategy in Singapore, reflecting the country's commitment to dementia as a public health priority. Timely and accurate diagnosis of dementia is important in recognising the disease burden within the nation and facilitates decisions on funding allocation.

Based on the review, we recommend a case-finding approach to identify possible dementia in at-risk populations, rather than community-wide or non-targeted population screening. This approach aligns with current screening guidelines both in Singapore and internationally. Subjective (e.g. self-reported or informant-rated) tools are recommended over performance-based tools. Among these, the iAD8 demonstrated superior diagnostic ability compared to sAD8. In the presence of a reliable informant, iAD8 alone had sufficient discriminant ability, with limited additional benefit when used in conjunction with other performance-based tools. Nonetheless, performance-based tools may still need to be considered if no reliable informant is present. Currently, in Singapore studies, AMT is the most studied performance-based tool with locally validated age and education-specific cut-offs. Further research is needed to specifically assess the diagnostic ability of brief cognitive screening tools—especially performance-based ones—in community settings, and to provide validation of cut-offs accounting for education and age in the Singapore population.

Declaration

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Supplementary materials

Supplementary Table S1A–D. Search strategies for PubMed, Embase, PsycInfo and Cochrane.

Supplementary Table S2. Risk-of-bias assessment on QUADAS-2 tool.

Supplementary Table S3. Extracted study characteristics of included studies.

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