



**TITLE: Screening Tools to Identify Adults with Cognitive Impairment Associated with Dementia: Diagnostic Accuracy**

**DATE:** 18 November 2014

## **RESEARCH QUESTION**

What is the diagnostic accuracy of screening tools to identify adults with cognitive impairment associated with dementia?

## **KEY FINDINGS**

Nine systematic reviews and meta-analyses, and 43 non-randomized studies were identified regarding the diagnostic accuracy of screening tools to identify adults with cognitive impairment associated with dementia. No relevant randomized controlled trials were identified.

## **METHODS**

A limited literature search was conducted on key resources including Medline, PubMed, The Cochrane Library (2014, Issue 10), University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. Methodological filters were applied to limit retrieval to health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, and non-randomized studies. Where possible retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2010 and October 30, 2014. Internet links were provided, where available.

The summary of findings was prepared from the abstracts of the relevant information. Please note that data contained in abstracts may not always be an accurate reflection of the data contained within the full article.

## **SELECTION CRITERIA**

One reviewer screened citations and selected studies based on the inclusion criteria presented in Table 1.

**Disclaimer:** The Rapid Response Service is an information service for those involved in planning and providing health care in Canada. Rapid responses are based on a limited literature search and are not comprehensive, systematic reviews. The intent is to provide a list of sources of the best evidence on the topic that CADTH could identify using all reasonable efforts within the time allowed. Rapid responses should be considered along with other types of information and health care considerations. The information included in this response is not intended to replace professional medical advice, nor should it be construed as a recommendation for or against the use of a particular health technology. Readers are also cautioned that a lack of good quality evidence does not necessarily mean a lack of effectiveness particularly in the case of new and emerging health technologies, for which little information can be found, but which may in future prove to be effective. While CADTH has taken care in the preparation of the report to ensure that its contents are accurate, complete and up to date, CADTH does not make any guarantee to that effect. CADTH is not liable for any loss or damages resulting from use of the information in the report.

**Copyright:** This report contains CADTH copyright material and may contain material in which a third party owns copyright. **This report may be used for the purposes of research or private study only.** It may not be copied, posted on a web site, redistributed by email or stored on an electronic system without the prior written permission of CADTH or applicable copyright owner.

**Links:** This report may contain links to other information available on the websites of third parties on the Internet. CADTH does not have control over the content of such sites. Use of third party sites is governed by the owners' own terms and conditions.

**Table 1: Selection Criteria**

<b>Population</b>	Adults with possible cognitive impairment associated with dementia
<b>Intervention</b>	Screening tools to identify cognitive impairment
<b>Comparator</b>	Screening tools compared with each other, clinician diagnosis
<b>Outcomes</b>	Diagnostic accuracy (e.g., sensitivity, specificity, AUROC, successful diagnosis)
<b>Study Designs</b>	Health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, non-randomized studies

**RESULTS**

Rapid Response reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews, and meta-analyses are presented first. These are followed by randomized controlled trials and non-randomized studies.

Nine systematic reviews and meta-analyses, and 43 non-randomized studies were identified regarding the diagnostic accuracy of screening tools to identify adults with cognitive impairment associated with dementia. No relevant randomized controlled trials were identified.

Additional references of potential interest are provided in the appendix.

**OVERALL SUMMARY OF FINDINGS**

Nine systematic reviews and meta-analyses<sup>1-9</sup>, and 43 non-randomized studies<sup>10-54</sup> were identified regarding the diagnostic accuracy of screening tools to identify adults with cognitive impairment associated with dementia. No relevant randomized controlled trials were identified. Details of included studies are summarized in Table 2.

**Table 2: Summary of Included Studies**

<b>First Author and Year</b>	<b>Patient Population</b>	<b>Index Test(s)</b>	<b>Comparator(s) or Reference Standard</b>	<b>Findings</b>
<b>Systematic Reviews and Meta-Analyses</b>				
Harrison, 2014 <sup>1</sup>	One study: N = 230; 16 with dementia Primary care setting	IQCODE; threshold 3.2	Clinical diagnosis	Sensitivity = 100% Specificity = 76%
		IQCODE; threshold 3.7		Sensitivity = 75% Specificity = 98%
Larner, 2014 <sup>2</sup>	10 studies: 5 ACE (N = 1090) 5 ACE-R (N = 1156)	ACE	MMSE	Sensitivity = 96.9% Specificity = 77.4%
		ACE-R		Sensitivity = 95.7% Specificity = 87.5% Greater accuracy than ACE and MMSE
Quinn, 2014 <sup>3</sup>	10 studies; N = 2644; 379 with dementia Community setting	IQCODE; threshold 3.3	Clinical diagnosis	Sensitivity = 0.80 Specificity = 0.84 PLR = 5.2 NLR = 0.23

**Table 2: Summary of Included Studies**

First Author and Year	Patient Population	Index Test(s)	Comparator(s) or Reference Standard	Findings
Yokomizo, 2014 <sup>4</sup>	13 studies	34 cognitive screening instruments	MMSE	6CIT, AMT, GPCOG, Mini-Cog, MIS, MoCA, and STMS are good alternatives to MMSE
Lin, 2013 <sup>5</sup>	55 studies	MMSE	Unspecified reference standard	Sensitivity = 88.3% Specificity = 86.2 %
		CDT, Mini-Cog, MIS, AMT, Short Portable Mental Status Questionnaire, FCSRT, 7MS		Limited evidence; generally reasonable performance with ranging sensitivity and specificity. MIS and AMT have low sensitivity.
Appels, 2010 <sup>6</sup>	Secondary care setting	Dementia screening instruments with 10 to 45 minute administration time	Not reported in abstract	Not reported in abstract
Mitchell, 2010 <sup>7</sup>	13 studies: community setting	Single-domain cognitive tests	MMSE	Sensitivity = 64.2% Specificity = 84.9% PPV = 57.1% NPV = 88.3%
	9 studies: primary care setting			Sensitivity = 69.5% Specificity = 82.5% PPV = 36.5% NPV = 95.8%
	23 studies: specialist setting			Sensitivity = 76.6% Specificity = 81.9% PPV = 80.8% NPV = 74.9%
Kansagara, 2010 <sup>8</sup>	Not reported in abstract	Brief mental status measures	Not reported in abstract	Not reported in abstract
<b>Non-Randomized Studies</b>				
Cummings-Vaughn, 2014 <sup>9</sup>	Veterans aged 60 and older; N = 136	SLUMS	CDR	AUROC = 0.98
		MoCA		AUROC = 0.96
		STMS		AUROC = 0.97
Hancock, 2014 <sup>10</sup>	Memory clinic patients; N = 242	Cornell Scale for Depression in Dementia	Clinical diagnosis	Modest performance for diagnosis of dementia.
Horton, 2014 <sup>11</sup>	N = 408; normal: n = 152 MCI: n = 169 AD: n = 87	abbreviated MoCA	MoCA	Higher AUROC for differentiating AD and MCI (0.93 vs. 0.89), AD and normal (0.98 vs. 0.97)

**Table 2: Summary of Included Studies**

First Author and Year	Patient Population	Index Test(s)	Comparator(s) or Reference Standard	Findings
			MMSE	Higher AUROC for differentiating AD and MCI (0.93 vs. 0.92), AD and normal (0.98 vs. 0.96)
Liew, 2014 <sup>12</sup>	N = 251; Dementia: n = 64	MoCA	Clinical diagnosis, CDR	AUROC = 0.99
Mitchell, 2014 <sup>13</sup>	N = 320; possible or probable AD: n = 139	DSRS	Clinical assessment	Accurately identified 78% of AD group
Russo, 2014 <sup>14</sup>	N = 147; mild AD: n = 56	Phototest, cut-off point for dementia 27/28	MMSE, CDT	Higher AUROC (0.97) than both comparators. Sensitivity = 89.29% Specificity = 96.67%
Wolfsgruber, 2014 <sup>15</sup>	Elderly individuals N = 1606	CERAD-NB Total Score	CERAD-NB single score, MMSE	AUROC = 0.97 for non-AD versus AD
Arabi, 2013 <sup>16</sup>	Elderly patients N = 155	Early Dementia Questionnaire	MMSE	Sensitivity = 79.2% Specificity = 52.7% PPV = 23.5% NPV = 93.2%
Babacan-Yildiz, 2013 <sup>17</sup>	N = 188; AD: n = 74	Cognitive State Test	CDR, MMSE, MoCA, Basic Activities of Daily Living	Optimal cut-off: 24/25 Sensitivity = 77% Specificity = 87%
Freitas, 2013 <sup>18</sup>	N = 360; AD: n = 90 AD controls: n = 90	MoCA	MMSE	AUROC = 0.980 Better sensitivity, specificity, PPV, NPV than MMSE at optimal cut-off (<17)
Haubois, 2013 <sup>19</sup>	N = 606 (dementia: n = 304); randomized: Derivation: n = 303 Validation: n = 303	SMMSE: derivation group	Clinical diagnosis	Sensitivity = 93.1% Specificity = 93.8% PPV = 94.3% NPV = 92.5% PLR = 14.9 NLR = 0.07
		SMMSE: validation group		Sensitivity = 93.8% Specificity = 90.5% PPV = 90.1% NPV = 94.0% PLR = 9.8 NLR = 0.07
Kvitting, 2013 <sup>20</sup>	Patients ≥ 65 years N = 81	AQT	Clinical diagnosis	AUROC = 0.773 Sensitivity = 0.587 Specificity = 0.909
		MMSE		Sensitivity = 0.587 Specificity = 0.909
		CDT		Sensitivity = 0.261 Specificity = 0.879

**Table 2: Summary of Included Studies**

First Author and Year	Patient Population	Index Test(s)	Comparator(s) or Reference Standard	Findings
		MMSE and CDT		Sensitivity = 0.696 Specificity = 0.788
		MMSE and AQT		Sensitivity = 0.913 Specificity = 0.636
Lam, 2013 <sup>21</sup>	N = 107; MCI: n = 32 AD: n = 75	MoCA	Clinical diagnosis (neuropsychological testing)	Memory function AUROC = 0.86 Executive function AUROC = 0.79 Visuospatial function AUROC = 0.79
Roalf, 2013 <sup>22</sup>	N = 587; AD: n = 321 MCI: n = 126 Healthy: n = 140	MMSE, MoCA, DSRS	CERAD-NB	MMSE and MoCA reasonably accurate; adding DSRS to either test significantly improved diagnostic accuracy.
Travers, 2013 <sup>23</sup>	Patients > 70 years N = 462	InterRAI Cognitive Performance Scale	Clinical diagnosis	AUROC = 0.83 Sensitivity = 0.68
		MMSE		AUROC = 0.87 Sensitivity = 0.75
Wang, 2013 <sup>24</sup>	Patients aged 60 to 90 years, N = 165 AD: n = 67 DLB: n = 36 Healthy: n = 62	MoCA	Clinical diagnosis	<u>AD: cut-off 21/22</u> Sensitivity = 95.5% Specificity = 82.3% AUROC = 0.945 <u>DLB: cut-off 22/23</u> Sensitivity = 91.7% Specificity = 80.6% AUROC = 0.932
		MMSE		<u>AD: cut-off 24/25</u> Sensitivity = 88.1% Specificity = 85.5% AUROC = 0.92 <u>DLB: cut-off 24/25</u> Sensitivity = 77.8% Specificity = 85.5% AUROC = 0.895
Freitas, 2012 <sup>25</sup>	N = 150; bv-FTD: n = 50 AD: n = 50 Healthy: n = 50	MoCA	MMSE	MoCA had significantly greater sensitivity, specificity, PPV, NPV, and classification accuracy than MMSE. AUROC = 0.934 vs. 0.772

**Table 2: Summary of Included Studies**

First Author and Year	Patient Population	Index Test(s)	Comparator(s) or Reference Standard	Findings
Fuchs, 2012 <sup>26</sup>	N = 423	Visual Association Test	Clinical diagnosis	Sensitivity = 95.2% Specificity = 96.0% PPV = 55.6% NPV = 99.7%
		Mini-Cog, CDT, verbal fluency, episodic memory, and subjective complaints		Mini-Cog and immediate and delayed recall next-most accurate tests.
Gavett, 2012 <sup>27</sup>	N = 276; AD: n = 65 non-AD: n = 211	Driving Scenes, Bill Payment, Daily Living Memory, Screening Visual Discrimination, Screening Design Construction, and Judgment Tests	Clinical diagnosis	Daily Living Memory test provided the greatest accuracy in the identification of AD.
Holsigner, 2012 <sup>28</sup>	Veterans aged ≥ 65 years N = 639	3MS	Clinical diagnosis	Sensitivity = 86% Specificity = 79%
		MIS		Sensitivity = 43% Specificity = 93%
		Mini-Cog		Sensitivity = 76% Specificity = 73%
		Two-item Functional Memory Screen		Sensitivity = 38% Specificity = 87%
Johansson, 2012 <sup>29</sup>	Patients with MCI or mild dementia, compared with non-dementia controls	Cognistat, RBMT	Clinical diagnosis, MMSE	Both tests have moderate validity in the detection of MCI and mild dementia, especially when used in combination. RBMT has fewer limitations than Cognistat.
Larner, 2012 <sup>30</sup>	N = 201	Mini-Mental Parkinson	MMSE	Optimal cut-off = < 17/32 Sensitivity = 0.51 Specificity = 0.97 PPV = 0.83 NPV = 0.87 AUROC = 0.89
Milian, 2012 <sup>31</sup>	N = 502; Dementia: n = 438 Healthy: n = 64	Mini-Cog	MMSE (cut-off < 24)	Discriminatory power = 86.6% vs. 72.6% Specificity = 100% (both tests)

**Table 2: Summary of Included Studies**

First Author and Year	Patient Population	Index Test(s)	Comparator(s) or Reference Standard	Findings
			CDT	Discriminatory power = 86.6% vs. 78.1% Specificity = 100% vs. 96.9%
Mormont, 2012 <sup>32</sup>	Patients with MMSE score > 15 N = 200	Five-word test (FRS, TRS, TWS)	FCSRT, MMSE	AUROC of MMSE, FRS, TRS, and TWS were not statistically different. <u>TWS cut-off &lt;15:</u> Any dementia: Sensitivity = 75% Specificity = 95.9% AD: Sensitivity = 90.2% Specificity = 95.9%
Takahashi, 2012 <sup>33</sup>	Elderly Japanese subjects, N = 280; Early dementia: n = 255 Controls: n = 22	AQT	CDR, MMSE, Neurobehavioural Cognitive Status Examination	AUROC = 0.88 <u>Cut-off 71/72 seconds:</u> Sensitivity = 85% Specificity = 76%
Verghese, 2012 <sup>34</sup>	Adults aged 55 to 94 years N = 304; Dementia: n = 65	Picture-based memory impairment screen	Clinical diagnosis	Optimal cut-off = 5 Sensitivity = 95.4% Specificity = 99.2% Improved accuracy in subjects with < 10 years education.
Aprahamian, 2011 <sup>35</sup>	Illiterate elderly patients N = 104; AD: n = 66 Controls: n = 40	MMSE, Verbal Fluency animal category, CDT, PFAQ	Clinical diagnosis	Most sensitive combination: MMSE and PFAQ (94.1%), Best specificity with combination of the MMSE and CDT (89%).
Baek, 2011 <sup>36</sup>	Elderly Korean adults N = 262; MCI: n = 112 AD: n = 97 Healthy: n = 53	Story recall test	CDR, Global Deterioration Scale, Korean versions of the MMSE and Hopkins Verbal Learning Test	The SRT was well-correlated with the comparator tests. Sensitivity and specificity were greatly influenced by education level.
Choi, 2011 <sup>37</sup>	N = 857; Dementia: n = 152 MCI: n = 66 Controls: n = 639	Literacy Independent Cognitive Assessment	CDR, Korean version of MMSE	AUROC = 0.985 <u>Literate; cut-off 186:</u> Sensitivity = 91.9% Specificity = 91.8% <u>Illiterate; cut-off 154.5:</u> Sensitivity = 96.2% Specificity = 91.1%

**Table 2: Summary of Included Studies**

First Author and Year	Patient Population	Index Test(s)	Comparator(s) or Reference Standard	Findings
Goncalves, 2011 <sup>38</sup>	N = 204	SMMSE	Clinical diagnosis	AUROC = 0.82
		RUDAS		AUROC = 0.83
		IQCODE		AUROC = 0.77
Hancock, 2011 <sup>39</sup>	N = 224	Test Your Memory	MMSE, ACE-R	Sensitivity = 0.73 Specificity = 0.88 PPV = 0.77 NPV = 0.86 AUROC = 0.89 Comparable diagnostic utility to MMSE and ACE-R.
Haubois, 2011 <sup>40</sup>	Elderly patients N = 184	SMMSE, cut-off < 4	Clinical diagnosis	Sensitivity = 89.5% Specificity = 85.4% PPV = 95.5% NPV = 70.0% PLR = 6.1 NLR = 8.1
		MMSE, cut-off < 24		Sensitivity = 90.0% Specificity = 75.5% PPV = 92.8% NPV = 68.9% PLR = 3.7 NLR = 7.7
Manly, 2011 <sup>41</sup>	Older adults N = 377; Normal: n = 256 MCI: n = 68 Dementia: n = 53	TICS	Clinical diagnosis	Sensitivity = 88% Specificity = 87%
		Dementia Questionnaire		Sensitivity = 66% Specificity = 89%
Terpening, 2011 <sup>42</sup>	N = 122; Dementia: n = 82 No dementia: n = 40	ACE-R, cut-off score 84/100	MMSE	Sensitivity = 0.85 Specificity = 0.80 PPV = 0.90 Superior to MMSE in patients with > 10 years education.
Chen, 2010 <sup>43</sup>	Patients > 50 years N = 1976; SMC: n = 475 MCI: n = 440 AD: 1061	Six-Item Screener	Battery of neuropsychological tests, including MMSE	Sensitivity = 88.5% Specificity = 78.3% Overall accuracy for detecting mild AD = 83.8%
Clionsky, 2010 <sup>44</sup>	Not reported in abstract	Memory Orientation Screening Test	MMSE, Mini-Cog	Significantly more sensitive than MMSE and Mini-Cog, twice as accurate as MMSe for identifying mild dementia.
Knopman, 2010 <sup>45</sup>	N = 167; Normal: n = 83 MCI: n = 42 Dementia: n = 42	TICS-modified	Clinical diagnosis	Cut-off ≤ 27 for MCI versus dementia: Sensitivity = 69.0%



**Table 2: Summary of Included Studies**

First Author and Year	Patient Population	Index Test(s)	Comparator(s) or Reference Standard	Findings
Leach, 2010 <sup>46</sup>	N = 66; Mild dementia: n = 33 Normal: n = 33	Kaplan-Baycrest Neurocognitive Assessment	Clinical diagnosis	Correctly classified 94% of sample Sensitivity = 0.91 Specificity = 0.97
Matioli, 2010 <sup>47</sup>	N = 60; VaD: n = 15 AD: n = 15 Healthy: n = 30	CDT, category and letter fluency, delayed recall of figures, EXIT 25 battery	Clinical diagnosis	Low sensitivity and specificity (all tests) to differentiate between VaD and dementia.
Morgan, 2010 <sup>48</sup>	Subjects aged 65 to 93 years N = 273; MCI: n = 38 AD: n = 100 PD: n = 35 Normal: n = 100	Repeatable Battery for the Assessment of Neuropsychological Status – Verbal and Visual Indices	Clinical diagnosis	For classification of normal versus AD: Sensitivity = 92.0% Specificity = 79.0%
Nair, 2010 <sup>49</sup>	Patients with memory complaints, MCI, AD N not reported in abstract	0 to 10 clock CDT, binary yes/no impairment system	Clinical diagnosis	CDT more predictive of clinical diagnosis than binary impairment scale, had excellent sensitivity to identify AD versus comparators.
Takechi, 2010 <sup>50</sup>	N = 182 AD: n = 128 Healthy: n = 54	MMSE, CDT, VFT, CCMT, SPMT (first shallow memory session, Pict 1, and second deep memory session, Pict 2)	Tests compared with each other	AUROC Pict 1 = AUROC Pict 2; AUROC SPMT > AUROC MMSE, CDT, VFT Same results for subgroups: patients > 75 years and < 75 years.
Upadhyaya, 2010 <sup>51</sup>	N = 209	MMSE	6CIT	<u>MMSE, cut-off 23/24</u> Sensitivity = 79.7% Specificity = 86.4% <u>6CIT, cut-off 10/11</u> Sensitivity = 82.5% Specificity = 90.9% <u>6CIT, cut-off 9/10</u> Sensitivity = 90.2% Specificity = 83.3%

**Table 2: Summary of Included Studies**

First Author and Year	Patient Population	Index Test(s)	Comparator(s) or Reference Standard	Findings
Wiechmann, 2010 <sup>52</sup>	Patients with VaD or AD N not reported in abstract	CDT, four point scoring system	Clinical diagnosis	Good sensitivity and specificity for dementia, utility for discriminating between VaD and AD not supported.

3MS = modified Mini-Mental State Examination; 6CIT = Six Item Cognitive Impairment Test; 7MS = 7-Minutes Screen; ACE = Addenbrooke's Cognitive Examination; ACE-R = Addenbrooke's Cognitive Examination – Revised; AD = Alzheimer Disease; AMT = Abbreviated Mental Test; AQT = A Quick Test of Cognitive Speed; AUROC = area under the receiver operating characteristic curve; bv-FTD = behavioural-variant frontotemporal dementia; CCMT = Verbal Category Cued Memory Test; CDR = Clinical Dementia Rating Scale; CDT = Clock Drawing Test; CERAD-NB = Consortium to Establish a Registry for Alzheimer's Disease neuropsychological assessment battery; DLB = dementia with Lewy bodies; DSRS = Dementia Severity Rating Scale; FCSRT = Free and Cued Selective Reminding Test; FRS = free recall score; GPCOG = General Practitioner Assessment of Cognition; IQCODE = Informant Questionnaire for Cognitive Decline in the Elderly; MCI = mild cognitive impairment; MIS = Memory Impairment Screen; MMSE = Mini-Mental State Examination; MoCA = Montreal Cognitive Assessment; NLR = negative likelihood ratio; NPV = negative predictive value; PD = Parkinson's disease; PFAQ = Pfeffer Functional Activities Questionnaire; PLR = positive likelihood ratio; PPV = positive predictive value; RUDAS = Rowland Universal Dementia Assessment Scale; SLUMS = Veterans Affairs Saint Louis University Mental Status; SMC = subjective memory complaints; SMMSE = Short Form of the Mini-Mental State Examination; SPMT = Scenery Picture Memory Test; STMS = Short Test of Mental Status; TICS = Telephone Interview for Cognitive Status; TRS = total recall score; TWS = total weighted score; VaD = vascular dementia; VFT = verbal fluency test

**REFERENCES SUMMARIZED****Health Technology Assessments**

No literature identified.

**Systematic Reviews and Meta-analyses**

1. Harrison JK, Fearon P, Noel-Storr AH, McShane R, Stott DJ, Quinn TJ. Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) for the diagnosis of dementia within a general practice (primary care) setting. *Cochrane Database Syst Rev*. 2014 Jul 3;(7):CD010771  
[PubMed: PM24990271](#)
2. Lerner AJ, Mitchell AJ. A meta-analysis of the accuracy of the Addenbrooke's Cognitive Examination (ACE) and the Addenbrooke's Cognitive Examination-Revised (ACE-R) in the detection of dementia. *Int Psychogeriatr*. 2014 Apr;26(4):555-63.  
[PubMed: PM24423470](#)
3. Quinn TJ1, Fearon P, Noel-Storr AH, Young C, McShane R, Stott DJ. Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) for the diagnosis of dementia within community dwelling populations. *Cochrane Database Syst Rev*. 2014 Apr 10;(4):CD010079.  
[PubMed: PM24719028](#)
4. Yokomizo JE, Simon SS, de Campos Bottino CM. Cognitive screening for dementia in primary care: a systematic review. *Int Psychogeriatr*. 2014 Nov;26(11):1783-804.  
[PubMed: PM25023857](#)
5. Lin JS, O'Connor E, Rossom RC, Perdue LA, Burda BU, Thompson M, et al. Screening for cognitive impairment in older adults: An evidence update for the U.S. Preventive Services Task Force [Internet]. Rockville (MD): Agency for Healthcare Research and Quality (US); 2013 Nov. (U.S. Preventive Services Task Force Evidence Syntheses, formerly Systematic Evidence Reviews) [cited 2014 Nov 13]. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK174643/pdf/TOC.pdf>  
[PubMed: PM24354019](#)
6. Appels BA, Scherder E. The diagnostic accuracy of dementia-screening instruments with an administration time of 10 to 45 minutes for use in secondary care: a systematic review. *Am J Alzheimers Dis Other Demen*. 2010 Jun;25(4):301-16.  
[PubMed: PM20539025](#)
7. Mitchell AJ, Malladi S. Screening and case-finding tools for the detection of dementia. Part II: evidence-based meta-analysis of single-domain tests. *Am J Geriatr Psychiatry*. 2010 Sep;18(9):783-800.  
[PubMed: PM20808094](#)
8. Kansagara D, Freeman M. A systematic evidence review of the signs and symptoms of dementia and brief cognitive tests available in VA [Internet]. Washington (DC): Department of Veterans Affairs (US); 2010 Apr. (VA Evidence-based Synthesis Program Reports) [cited 2014 Nov 13]. Available from:

<http://www.ncbi.nlm.nih.gov/books/NBK49021/>

### Randomized Controlled Trials

No literature identified.

### Non-Randomized Studies

9. Cummings-Vaughn LA, Chavakula NN, Malmstrom TK, Tumosa N, Morley JE, Cruz-Oliver DM. Veterans Affairs Saint Louis University Mental Status examination compared with the Montreal Cognitive Assessment and the Short Test of Mental Status. *J Am Geriatr Soc*. 2014 Jul;62(7):1341-6.  
[PubMed: PM24916485](#)
10. Hancock P, Lerner AJ. Cornell Scale for Depression in Dementia: Clinical utility in a memory clinic. *Int J Psychiatry Clin Pract*. 2014 Jul 23;1-4.  
[PubMed: PM24994480](#)
11. Horton D, Ream D, Pandya S, Clem M, Hynan L, Rossetti H, et al. A-70An Abbreviated MoCA to Differentiate Normal Cognition, Mild Cognitive Impairment, and Alzheimer's Disease. *Arch Clin Neuropsychol*. 2014 Sep;29(6):529, 2014.  
[PubMed: PM25176732](#)
12. Liew TM, Feng L, Gao Q, Ng TP, Yap P. Diagnostic Utility of Montreal Cognitive Assessment in the Fifth Edition of Diagnostic and Statistical Manual of Mental Disorders: Major and Mild Neurocognitive Disorders. *J Am Med Dir Assoc*. 2014 Oct 1.  
[PubMed: PM25282632](#)
13. Mitchell JC, Dick MB, Wood AE, Tapp AM, Ziegler R. The Utility of the Dementia Severity Rating Scale in Differentiating Mild Cognitive Impairment and Alzheimer Disease From Controls. *Alzheimer Dis Assoc Disord*. 2014 Sep 1.  
[PubMed: PM25187220](#)
14. Russo MJ, Iturry M, Sraka MA, Bartoloni L, Carnero PC, Allegri RF. Diagnostic accuracy of the Phototest for cognitive impairment and dementia in Argentina. *Clin Neuropsychol*. 2014;28(5):826-40.  
[PubMed: PM24970674](#)
15. Wolfsgruber S, Jessen F, Wiese B, Stein J, Bickel H, Mosch E, et al. The CERAD neuropsychological assessment battery total score detects and predicts alzheimer disease dementia with high diagnostic accuracy. *Am J Geriatr Psychiatry*. 2014 Oct;22(10):1017-28.  
[PubMed: PM23759289](#)
16. Arabi Z, Aziz NA, Abdul Aziz AF, Razali R, Wan Puteh SE. Early Dementia Questionnaire (EDQ): a new screening instrument for early dementia in primary care practice. *BMC Fam Pract* [Internet]. 2013 [cited 2014 Nov 13];14:49, 2013. Available from:  
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3637632>  
[PubMed: PM23586732](#)

17. Babacan-Yildiz G, Isik AT, Ur E, Aydemir E, Ertas C, Cebi M, et al. COST: Cognitive State Test, a brief screening battery for Alzheimer disease in illiterate and literate patients. *Int Psychogeriatr.* 2013 Mar;25(3):403-12.  
[PubMed: PM23137551](#)
18. Freitas S, Simoes MR, Alves L, Santana I. Montreal cognitive assessment: validation study for mild cognitive impairment and Alzheimer disease. *Alzheimer Dis Assoc Disord.* 2013 Jan;27(1):37-43.  
[PubMed: PM22193353](#)
19. Haubois G, de DL, Annweiler C, Launay C, Allali G, Herrmann FR, et al. Derivation and validation of a Short Form of the Mini-Mental State Examination for the screening of dementia in older adults with a memory complaint. *Eur J Neurol.* 2013 Mar;20(3):588-90.  
[PubMed: PM22913655](#)
20. Kvitting AS, Wimo A, Johansson MM, Marcusson J. A quick test of cognitive speed (AQT): usefulness in dementia evaluations in primary care. *Scand J Prim Health Care [Internet].* 2013 Mar [cited 2014 Nov 13];31(1):13-9. Available from:  
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3587304>  
[PubMed: PM23293859](#)
21. Lam B, Middleton LE, Masellis M, Stuss DT, Harry RD, Kiss A, et al. Criterion and convergent validity of the Montreal cognitive assessment with screening and standardized neuropsychological testing. *J Am Geriatr Soc.* 2013 Dec;61(12):2181-5.  
[PubMed: PM24320735](#)
22. Roalf DR, Moberg PJ, Xie SX, Wolk DA, Moelter ST, Arnold SE. Comparative accuracies of two common screening instruments for classification of Alzheimer's disease, mild cognitive impairment, and healthy aging. *Alzheimer's dement.* 2013 Sep;9(5):529-37.  
[PubMed: PM23260866](#)
23. Travers C, Byrne GJ, Pachana NA, Klein K, Gray L. Validation of the interRAI Cognitive Performance Scale against independent clinical diagnosis and the Mini-Mental State Examination in older hospitalized patients. *J Nutr Health Aging.* 2013;17(5):435-9.  
[PubMed: PM23636544](#)
24. Wang CS, Pai MC, Chen PL, Hou NT, Chien PF, Huang YC. Montreal Cognitive Assessment and Mini-Mental State Examination performance in patients with mild-to-moderate dementia with Lewy bodies, Alzheimer's disease, and normal participants in Taiwan. *Int Psychogeriatr.* 2013 Nov;25(11):1839-48.  
[PubMed: PM23919950](#)
25. Freitas S, Simoes MR, Alves L, Duro D, Santana I. Montreal Cognitive Assessment (MoCA): validation study for frontotemporal dementia. *J Geriatr Psychiatry Neurol.* 2012 Sep;25(3):146-54.  
[PubMed: PM22859702](#)
26. Fuchs A, Wiese B, Altiner A, Wollny A, Pentzek M. Cued recall and other cognitive tasks to facilitate dementia recognition in primary care. *J Am Geriatr Soc.* 2012 Jan;60(1):130-5.

- [PubMed: PM22150245](#)
27. Gavett BE, Lou KR, Daneshvar DH, Green RC, Jefferson AL, Stern RA. Diagnostic accuracy statistics for seven Neuropsychological Assessment Battery (NAB) test variables in the diagnosis of Alzheimer's disease. *Appl Neuropsychol Adult*. 2012;19(2):108-15.  
[PubMed: PM23373577](#)
  28. Holsinger T, Plassman BL, Stechuchak KM, Burke JR, Coffman CJ, Williams JW, Jr. Screening for cognitive impairment: comparing the performance of four instruments in primary care. *J Am Geriatr Soc*. 2012 Jun;60(6):1027-36.  
[PubMed: PM22646750](#)
  29. Johansson M, Wressle E. Validation of the neurobehavioral cognitive status examination and the Rivermead Behavioural Memory Test in investigations of dementia. *Scand J Occup Ther*. 2012 May;19(3):282-7.  
[PubMed: PM21105840](#)
  30. Larner AJ. Mini-mental Parkinson (MMP) as a dementia screening test: comparison with the Mini-Mental State Examination (MMSE). *Curr Aging Sci*. 2012 Jul;5(2):136-9.  
[PubMed: PM21834788](#)
  31. Milian M, Leiherr AM, Straten G, Muller S, Leyhe T, Eschweiler GW. The Mini-Cog versus the Mini-Mental State Examination and the Clock Drawing Test in daily clinical practice: screening value in a German Memory Clinic. *Int Psychogeriatr*. 2012 May;24(5):766-74.  
[PubMed: PM22172089](#)
  32. Mormont E, Jamart J, Robaye L. Validity of the five-word test for the evaluation of verbal episodic memory and dementia in a memory clinic setting. *J Geriatr Psychiatry Neurol*. 2012 Jun;25(2):78-84.  
[PubMed: PM22689699](#)
  33. Takahashi F, Awata S, Sakuma N, Inagaki H, Ijuin M. Reliability and validity of A Quick Test of Cognitive Speed for detecting early-stage dementia in elderly Japanese. *Psychogeriatrics*. 2012 Jun;12(2):75-82.  
[PubMed: PM22712639](#)
  34. Verghese J, Noone ML, Johnson B, Ambrose AF, Wang C, Buschke H, et al. Picture-based memory impairment screen for dementia. *J Am Geriatr Soc* [Internet]. 2012 Nov [cited 2014 Nov 13];60(11):2116-20. Available from:  
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3679906>  
[PubMed: PM23039180](#)
  35. Aprahamian I, Martinelli JE, Cecato J, Yassuda MS. Screening for Alzheimer's disease among illiterate elderly: accuracy analysis for multiple instruments. *J Alzheimers Dis*. 2011;26(2):221-9.  
[PubMed: PM21593559](#)
  36. Baek MJ, Kim HJ, Ryu HJ, Lee SH, Han SH, Na HR, et al. The usefulness of the story recall test in patients with mild cognitive impairment and Alzheimer's disease. *Neuropsychol*. 2011 Mar;dev. cogn., Sect. B, Aging neuropsychol. cogn.. 18(2):214-29.

[PubMed: PM21229403](#)

37. Choi SH, Shim YS, Ryu SH, Ryu HJ, Lee DW, Lee JY, et al. Validation of the Literacy Independent Cognitive Assessment. *Int Psychogeriatr*. 2011 May;23(4):593-601.  
[PubMed: PM20843392](#)
38. Goncalves DC, Arnold E, Appadurai K, Byrne GJ. Case finding in dementia: comparative utility of three brief instruments in the memory clinic setting. *Int Psychogeriatr*. 2011 Jun;23(5):788-96.  
[PubMed: PM21223627](#)
39. Hancock P, Lerner AJ. Test Your Memory test: diagnostic utility in a memory clinic population. *Int J Geriatr Psychiatry*. 2011 Sep;26(9):976-80.  
[PubMed: PM21845600](#)
40. Haubois G, Annweiler C, Launay C, Fantino B, de DL, Allali G, et al. Development of a short form of Mini-Mental State Examination for the screening of dementia in older adults with a memory complaint: a case control study. *BMC Geriatr* [Internet]. 2011 [cited 2014 Nov 13];11:59, 2011. Available from:  
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3203031>  
[PubMed: PM21970520](#)
41. Manly JJ, Schupf N, Stern Y, Brickman AM, Tang MX, Mayeux R. Telephone-based identification of mild cognitive impairment and dementia in a multicultural cohort. *Arch Neurol* [Internet]. 2011 May [cited 2014 Nov 13];68(5):607-14. Available from:  
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3102767>  
[PubMed: PM21555635](#)
42. Terpening Z, Cordato NJ, Hepner IJ, Lucas SK, Lindley RI. Utility of the Addenbrooke's Cognitive Examination--Revised for the diagnosis of dementia syndromes. *Australas J Ageing*. 2011 Sep;30(3):113-8.  
[PubMed: PM21923703](#)
43. Chen MR, Guo QH, Cao XY, Hong Z, Liu XH. A preliminary study of the Six-Item Screener in detecting cognitive impairment. *Neurosci Bull*. 2010 Aug;26(4):317-21.  
[PubMed: PM20651813](#)
44. Clionsky MI, Clionsky E. Development and validation of the Memory Orientation Screening Test (MOST): A better screening test for dementia. *Am J Alzheimers Dis Other Demen*. 2010 Dec;25(8):650-6.  
[PubMed: PM21131671](#)
45. Knopman DS, Roberts RO, Geda YE, Pankratz VS, Christianson TJ, Petersen RC, et al. Validation of the telephone interview for cognitive status-modified in subjects with normal cognition, mild cognitive impairment, or dementia. *Neuroepidemiology* [Internet]. 2010[cited 2014 Nov 13];34(1):34-42. Available from:  
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2857622>  
[PubMed: PM19893327](#)

46. Leach L. The diagnostic prediction of the Kaplan-Baycrest neurocognitive assessment for identification of mild dementia. Arch Clin Neuropsychol. 2010 Aug;25(5):359-70.  
[PubMed: PM20501507](#)
47. Matioli MN, Caramelli P. Limitations in differentiating vascular dementia from Alzheimer's disease with brief cognitive tests. Arq Neuropsiquiatr. 2010 Apr;68(2):185-8.  
[PubMed: PM20464282](#)
48. Morgan DR, Linck J, Scott J, Adams R, Mold J. Assessment of the RBANS Visual and Verbal Indices in a sample of neurologically impaired elderly participants. Clin Neuropsychol. 2010 Nov;24(8):1365-78.  
[PubMed: PM20954101](#)
49. Nair AK, Gavett BE, Damman M, Dekker W, Green RC, Mandel A, et al. Clock drawing test ratings by dementia specialists: interrater reliability and diagnostic accuracy. J Neuropsychiatry Clin Neurosci [Internet]. 2010 [cited 2014 Nov 13];22(1):85-92. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2938787>  
[PubMed: PM20160214](#)
50. Takechi H, Dodge HH. Scenery Picture Memory Test: a new type of quick and effective screening test to detect early stage Alzheimer's disease patients. Geriatr Gerontol Int [Internet]. 2010 Apr [cited 2014 Nov 13];10(2):183-90. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2892033>  
[PubMed: PM20446933](#)
51. Upadhyaya AK, Rajagopal M, Gale TM. The Six Item Cognitive Impairment Test (6-CIT) as a screening test for dementia: comparison with Mini-Mental State Examination (MMSE). Curr Aging Sci. 2010 Jul;3(2):138-42.  
[PubMed: PM20158493](#)
52. Wiechmann AR, Hall JR, O'Bryant S. The four-point scoring system for the clock drawing test does not differentiate between Alzheimer's disease and vascular dementia. Psychol Rep. 2010 Jun;106(3):941-8.  
[PubMed: PM20712183](#)

**PREPARED BY:**

Canadian Agency for Drugs and Technologies in Health  
Tel: 1-866-898-8439  
[www.cadth.ca](http://www.cadth.ca)



**APPENDIX – FURTHER INFORMATION:**

**Systematic Reviews and Meta-analyses – Combined Cognitive Impairment Results Not Limited to Dementia**

53. Mitchell AJ. A meta-analysis of the accuracy of the mini-mental state examination in the detection of dementia and mild cognitive impairment. *J Psychiatr Res.* 2009 Jan;43(4):411-31. doi: 10.1016/j.jpsychires.2008.04.014. Epub 2008 Jun 24.  
[PubMed: PM18579155](#)

**Non-Randomized Studies – Combined Cognitive Impairment Results Not Limited to Dementia**

54. Brown JM, Wiggins J, Dong H, Harvey R, Richardson F, Hunter K, et al. The hard Test Your Memory. Evaluation of a short cognitive test to detect mild Alzheimer's disease and amnesic mild cognitive impairment. *Int J Geriatr Psychiatry.* 2014 Mar;29(3):272-80.  
[PubMed: PM23929807](#)
55. Gagnon G, Hansen KT, Woolmore-Goodwin S, Gutmanis I, Wells J, Borrie M, et al. Correcting the MoCA for education: effect on sensitivity. *Can J Neurol Sci.* 2013 Sep;40(5):678-83.  
[PubMed: PM23968941](#)
56. Larner AJ. Screening utility of the Montreal Cognitive Assessment (MoCA): in place of--or as well as--the MMSE? *Int Psychogeriatr.* 2012 Mar;24(3):391-6.  
[PubMed: PM22014176](#)
57. Carpenter CR, Bassett ER, Fischer GM, Shirshekan J, Galvin JE, Morris JC. Four sensitive screening tools to detect cognitive dysfunction in geriatric emergency department patients: brief Alzheimer's Screen, Short Blessed Test, Ottawa 3DY, and the caregiver-completed AD8. *Acad Emerg Med [Internet].* 2011 Apr [cited 2014 Nov 13];18(4):374-84. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3080244>  
[PubMed: PM21496140](#)
58. Damian AM, Jacobson SA, Hentz JG, Belden CM, Shill HA, Sabbagh MN, et al. The Montreal Cognitive Assessment and the mini-mental state examination as screening instruments for cognitive impairment: item analyses and threshold scores. *Dement Geriatr Cogn Disord.* 2011;31(2):126-31.  
[PubMed: PM21282950](#)
59. Dougherty JH, Jr., Cannon RL, Nicholas CR, Hall L, Hare F, Carr E, et al. The computerized self test (CST): an interactive, internet accessible cognitive screening test for dementia. *J Alzheimers Dis.* 2010;20(1):185-95.  
[PubMed: PM20164591](#)
60. Leung JL, Lee GT, Lam YH, Chan RC, Wu JY. The use of the Digit Span Test in screening for cognitive impairment in acute medical inpatients. *Int Psychogeriatr.* 2011 Dec;23(10):1569-74.  
[PubMed: PM21729426](#)

61. Scharre DW, Chang SI, Murden RA, Lamb J, Beversdorf DQ, Kataki M, et al. Self-administered Gerocognitive Examination (SAGE): a brief cognitive assessment Instrument for mild cognitive impairment (MCI) and early dementia. *Alzheimer Dis Assoc Disord*. 2010 Jan;24(1):64-71.  
[PubMed: PM20220323](#)