SESLHD GUIDELINE

COVER SHEET

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SUMMARY	The aim of this document is to provide an evidence-based overview of available cognitive screening tools and assist clinicians to make decisions based on best practice in their use with specific clinical populations.

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An evidence-based guide to cognitive screening measures

Acknowledgement

South Eastern Sydney Local Health District respectfully acknowledges Aboriginal and Torres Strait Islander people as Traditional Custodians of their land, we also acknowledge both past and present Elders, and their continuing connection to country.

Section 1 - Background

Cognitive screening is used to evaluate a person's current level of general cognitive functioning in order to identify if they are at high risk for a specific neurocognitive condition or disorder.

It most commonly involves the administration of a limited number of brief 'bedside tests' of memory, orientation to time and place, and other thinking tasks. Interpretation is typically binary (pass/fail) and is based on whether the individual's total performance score falls above or below a pre-specified cut-off criterion. It is brief and narrow in scope, and differs from cognitive assessment in terms of the depth and breadth of evaluation methods employed, level of integration of the test results with other forms of evidence, the investment of time and resources by the clinician, the intended outcome goals, and accuracy. While cognitive screens can indicate the need for further evaluation or investigation, they should not be used as a diagnostic tool nor their results interpreted to definitively indicate a specific condition or disorder, such as dementia.

The purpose of the guide is to provide an overview of available cognitive screening tools, along with a summary of the evidence-base for their use with specific clinical populations; namely Older Adults, Mental Health, Neurological / Rehabilitation and Alcohol and other Drugs. The guide also outlines considerations for the use of cognitive screening measures with Aboriginal and Torres Strait Islander people. The guide does not consider cognitive screening in children and adolescents.

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Appendix A: An evidence-based guide to cognitive screening measures

Health
South Eastern Sydney
Local Health District

An Evidence-Based Guide to Cognitive Screening Measures

December 2020

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Introduction

Cognitive screening is used to evaluate a person's current level of general cognitive functioning in order to identify if they are at high risk for a specific neurocognitive condition or disorder. It most commonly involves the administration of a limited number of brief 'bedside tests' of memory, orientation to time and place, and other thinking tasks. Interpretation is typically binary (pass/fail) and is based on whether the individual's total performance score falls above or below a pre-specified cut-off criterion. It is brief and narrow in scope, and differs from cognitive assessment in terms of the depth and breadth of evaluation methods employed, level of integration of the test results with other forms of evidence, the investment of time and resources by the clinician, the intended outcome goals, and accuracy (Block, Johnson-Greene, Pliskin, & Boake, 2017). While a cognitive screen may indicate the need for further evaluation or investigation, it should not be used as a stand-alone diagnostic tool nor the results over-interpreted to definitively indicate a specific condition or disorder, such as dementia.

Differentiating between a cognitive screen and an assessment;

A **screen** is generally brief and narrow in scope and is used for the early identification of individuals at potentially high risk for a specific condition or disorder. It is neither definitively diagnostic nor a definitive indication of a specific condition or disorder, rather it may indicate a need for further evaluation or investigation. A screen may be administered as part of a routine clinical encounter or used to monitor treatment progress, outcome, or changes in symptoms over time.

An **assessment** provides a more complete clinical picture of an individual and is comprehensive in focusing on the individual's functioning across multiple domains, such as memory and language, visual and verbal problem solving, executive functioning, adaptive functioning, psychological status and capacity for self-care and decision-making. An assessment can aid in diagnosis and/or treatment planning in a culturally competent manner. It integrates results from multiple sources, including multiple measures, clinical interviews, behavioral observations, clinical record reviews, and collateral information to identify specific problems and conditions, indicate their severity, and provide treatment recommendations.

Sourced from the American Psychological Association.

A good cognitive screening tool should be quick and easy to administer at the bedside, and accurate in its ability to determine a person's general level of cognitive functioning at that particular point in time. Interpretation should also be quick and easy. It should be based on neuro-behavioural testing principles, in that most healthy people with an average level of usual intellectual functioning should be able to perform all of the screening tasks almost perfectly. In an ideal scenario, interpretation should be straightforward: if the person performs well (that is, above the set cut-off score), this should indicate that they are functioning at an adequate (average) level in those specific cognitive domains that are being screened for, and thus there is no indication of a possible underlying neurocognitive disorder. The usefulness of such a quick and easy cognitive screening process in the health setting is obvious.

Considerations for interpreting the results of cognitive screening tests

When interpreting a person's performance, clinicians need to consider the influence of a number of factors. To start with, the '**sensitivity**' and '**specificity**' of a screening tool needs to be considered. Test sensitivity is the ability of the screening tool to correctly identify those with the disease (true positive rate), whereas test specificity is the ability of the test to correctly identify those without the disease (true negative rate). When evaluating the usefulness of a screening measure, Blake, McKinney, Treece, Lee and Lincoln (2002) recommend that a good sensitivity (> 80%) is required, while also maintaining a low false positive rate (specificity > 60%).

Whilst interpretation of a good performance is relatively straightforward (although, see below), interpretation of a poor performance (that is, a score below the set cut-off score) is more difficult to interpret. Clinicians need to be mindful of the specificity of the tool, in particular, so as to avoid concluding that there is impairment suggestive of a condition or disorder when the person does not, in fact, have a neurocognitive disorder. There are a great many reasons why an otherwise neurocognitively healthy person might perform poorly on a cognitive screening tool on a given occasion. For instance, from an environmental setting point of view, they might not be able to hear or follow the test instructions in a busy, noisy ED environment especially if they are hearing-impaired; if they are newly admitted to a ward, the person might be too distracted to pay attention to the test instructions due to the temporary influence of anxiety, bewilderment, distress, pain, or discomfort; or they just might not be convinced of the worth of putting effort into engaging in the screening process at that point in time despite the enthusiasm of the clinician.

Other less malleable demographic and biomedical factors might also play a role in influencing a person's poor performance. These include a low level of education, low literacy, low intellect, a CALD background; also, the impact of overly sedative or arousing medications, the presence of an unrecognised delirium; and most importantly in the rehabilitation and geriatric setting, the influence of advanced age. In reference to this latter issue, most cognitive screening tools used in the geriatric setting (see below) have cut-offs that are based on a sample of healthy 50-70 year old people, so thoughtful adjustments may need to be made to the cut-offs for classifying impairment when applying these tests in people of advanced age (Callow, Alpass, Leathem, & Stephens, 2015; Cheung et al., 2015).

Conversely, in the process of interpreting a 'good' performance in a person whose usual level of cognitive and intellectual functioning is well above average, clinicians need to be particularly mindful of the sensitivity of the tool, so as to avoid interpreting a performance as reflecting the absence of a neurocognitive disorder when the person might actually be performing significantly below their usual level of cognitive functioning. In this situation, most cognitive screening tools may be pitched at a too simple a level, and will miss detecting the early stages of a neurocognitive disorder (Garrett, Perry, Williams, Korinek, & Bazzo, 2020).

Clinicians' also need to be aware that the downside to the attractive brevity of cognitive screening tools is their reduced **reliability**. For example, only having a single item for the evaluation of 'memory', leaves no room for a person's momentary distraction; there is no opportunity for the person to demonstrate a good performance on a second measure of memory a few moments later when they have regained their focus (as is the case during a neuropsychological assessment, where multiple points of evidence for an impairment in a specific domain are gathered over a longer period of observation and often from different sources).

Likewise, all cognitive tools have a degree of 'measurement error', where scores may differ from day to day, or even hour to hour, even when given to an otherwise healthy person. This is particularly true for short cognitive screening tools. This is relevant to allow for when interpreting a change in performance score from one point in time to another (e.g. from one year to the next).). For instance, recent research (Feeney, Savva, O'Regan et al, 2016) suggests that a change greater than or equal to 3 points on the MMSE and 4 points on the MoCA is required to be confident that the change is not due to measurement error alone, and instead reflects a clinically meaningful change in the person's neurocognitive status. Clinicians therefore need to consider the test's **re-test reliability** and the clinical relevance of the degree of difference between the two scores (such data are usually available in the tool's manual, or in scientific articles published on the psychometric properties of the tools).

When considering which tool to choose, it is important to note that all cognitive screening tools are designed to detect the early signs of specific types of neurocognitive conditions. The subtests that are selected for inclusion in a particular tool will depend upon the specific neurocognitive condition of interest. For instance, the subtests selected for inclusion in the mini mental status exam (MMSE) were chosen for their sensitivity for detecting the most common early cognitive changes of Alzheimer's Disease (i.e. temporal and parietal lobe dysfunction). Consequently, this tool is not particularly sensitive in its ability to detect the pattern of neurocognitive dysfunction found in the early stages of the frontal lobe dementias, alcohol-related dementia, or the subcortical dementias (Devenney & Hodges, 2017).

It follows, then, that cognitive screening tools should only be applied within those specific populations of people where they have been validated for use, and they should not be over-interpreted even when applied within those appropriate populations. For instance, cognitive screening tools are not reliable enough to be used as a stand-alone instrument to 'diagnose' dementia, and they are not validated for use as a test of a 'mental fitness'[1].

Similarly, cognitive screening tools are not designed to provide an estimate of someone's everyday functional ability such as their ability to perform instrumental activities of daily living, or their capacity to make certain decisions such as what medical care they receive (or decline) or where they should live upon discharge from hospital. That is, most cognitive screening tools do not have clearly established '**ecological validity'**. Nevertheless, recently there has been some attempt to clarify the association between performances on cognitive screening tools and everyday functioning in dementia (Giebel and Challis, 2016; So, Foxe, Kumfor, et al, 2018), at least. So this type of useful clinical information is beginning to emerge.

Finally, consideration should also be given as to whether the client identifies as of Aboriginal and/or Torres Strait Islander origin. Any assessment of an Indigenous person should be 'wholistic; strength-based not deficit focused; involves family historians; involves appraisal of the individual within the person's social and kinship network' (see Working Together). Psychometric assessment (including screening), in many instances, may not be an appropriate means to measure cognitive function

[1] "Donald Trump takes an exam created by Canadian immigrant doctor to test mental fitness" January 2018: https://dailyhive.com/vancouver/donald-trump-canadian-montreal-cognitive-exam

in First Nations' people. There are efforts currently being made to develop culturally appropriate assessment tools, however these remain limited (see the Guddi Way; and the KICA).

Similarly, cognitive screening or assessments conducted with Individuals from culturally and linguistically diverse (CALD) backgrounds should utilise practices and measures that are appropriate and minimise cultural and linguistic bias. Interpreters should be used for people with low-English proficiency and consideration given to culture in addition to linguistic diversity when interpreting results. Some of the more common cognitive screening tools have translated versions available, though it is important to remember to check if a measure has been re-validated post-translation. There are also cognitive screening tools that have been developed and validated for use in multicultural populations (see the RUDAS and the Mini-cog).

In summary, cognitive screening tests are best used in the clinical setting as one part of a comprehensive, multidisciplinary assessment process within a specific patient to evaluate a person's current level of general cognitive functioning in order to identify if they are at high risk for a specific neurocognitive condition or disorder. This multidisciplinary assessment process should almost always include a thorough functional assessment of a person's everyday cognitive functioning (usually conducted by an occupational therapist). An informed, experienced clinician will take all of the above factors into consideration when choosing where and when to attempt to administer a cognitive screening tool, how best to engage the person in participating actively in the screening process, how much weight to place on the significance of a single performance score, and more broadly how to interpret the results clinically.

Applied sensibly, with the above-listed considerations in mind, cognitive screening tools can be useful for evaluating a person's current level of general cognitive functioning. They are useful for detecting early signs of a possible underlying neurocognitive disorder, for monitoring gross changes in a person's cognitive functioning over time, and for guiding the need for further investigation, such as neuropsychological assessment.

The Purpose of this Guide

The purpose of this guide is to provide an overview of:

1. Evidence-based guidelines for specific populations
    a. Older Adults
    b. Mental Health
    c. Neurological / Rehabilitation
    d. Alcohol and other Drugs
    e. Aboriginal and Torres Strait Islander Peoples
2. Available cognitive screening tools

*Please note that this document does not consider cognitive screening in children and adolescents.

Section One: Best Practice Guidelines for Cognitive Screening in Specific Populations

Older Adults

The ACE-III, MoCA and MMSE appear to be the most widely used cognitive screening tools within the older adult geriatric populations according to the literature reviewed. However, consideration should be given towards using the 3MS in substitute of the MMSE when attempting to discriminate mild cognitive impairment (MCI) from normal cognition as the sensitivity of the 3MS is higher than MMSE suggesting enhanced detection of early cognitive decline in older adults (Ryan et al 2019). The ACE-III, MoCA and RUDAS are strongly correlated with one another when screening for mild dementia. It is suggested that optimal cut-off points are lowered for older age groups >70 year olds, with ACE-III cut-off 76/100 (sensitivity= 81.1%, specificity= 85.1%), MoCA 20/30 (sensitivity= 78.4%, specificity= 83.0%), and RUDAS 22/30 (sensitivity= 78.4%, specificity= 85.1%) (Cheung et al 2015). The RUDAS is not especially affected by gender, education, and preferred language however it is less clear about the influence on age (Cheung et al 2015). The MoCA is superior to MMSE in the identification of MCI, and both tests were found to be accurate in the detection of Alzheimer's dementia. MMSE testing results are affected by age, ethnicity, education and literacy and there is poor sensitivity to other dementia types (Pinto et al 2019). The Mini-Ace with cut off score ≤21/30 is almost certain to be a score come from a person with dementia regardless of the clinical setting and has been found to be superior to the MMSE and MoCA in diagnostic utility for dementia patients (Bruno et al 2019). Further studies of the Mini-ACE are required as there is no definite comment made about test utility for patient's ≤75 years old (Larner et al 2020). The FAB can also be considered a valid screening tool to determine the prevalence of dysexecutive syndrome with a FAB score ≥12 points (D'Onofrio et al 2018) distinguishing between frontotemporal lobe dementia and early Alzheimer's disease (sensitivity 77%, Specificity 87%, Slachevsky et al 2004) as well as score < 14 distinguishing between progressive supranuclear palsy and multisystem atrophy or Parkinson's disease (sensitivity and specificity 78%, Paviour et al 2005).

Cognitive screens such as MMSE, MoCA and RUDAS all yield high diagnostic accuracy for mild Alzheimer's Dementia, with the ACE-III achieving the highest diagnostic properties patients with full primary education than in the less educated group (Matias-Guiu et al 2017). ACE-III scores were significantly related to functional ability on the Clinical Dementia Rating Scale across all dementia types except Semantic dementia (So et al 2018). There appears to be minimal research conducted on older adult >90 years of age, in terms of cognitive screening tool best practice, differentials and scoring.

Consideration should also be given as to whether delirium is present. Delirium is an acute change in mental status that is common among older patients in hospital. It is characterised by a disturbance of consciousness, attention, cognition and perception that develops over a short period of time (usually hours to a few days). It is recommended that all clients over the age of 65 (over 45 years for Aboriginal or Torres Strait Islander peoples or those with an intellectual disability) or those at higher risk should be screened to identify their risk of delirium.

When assessing for delirium, there are a number of cognitive screening tools that can be utilised, depending on the individual/population, including the Abbreviated Mental Test (AMT), Rapid Assessment Test for Delirium (4AT), the RUDAS (for people from CALD backgrounds) or one of the validated cognitive screens identified

within this document. An abnormal result should be followed by the administration of the Confusion Assessment Method (CAM) to diagnose delirium (SESLHDPR/345 Prevention, Diagnosis and Management of Delirium in Older People) and any concerns that delirium may be present escalated as a medical emergency.

Mental Health

In the literature reviewed, the most commonly validated tools in the mental health setting were the MoCA (Dautzenberg et al., 2020; Gil-Berrozpe et al., 2020; Musso et al., 2018; Yhang et al., 2018) and the MMSE ((including the updated 3MS) Alvarez Grandi et al, 2020; Faustman et al., 1990; Mackin et al., 2010; Moore et al., 2004). However, when these tools have been compared, the MoCA has been found to be more accurate in detecting cognitive impairment in mental health consumers, in both people with schizophrenia spectrum illnesses (Rosca et al., 2020) and those undertaking electroconvulsive therapy (ECT; Moirand et al., 2018;). This has proposed to be secondary to its inclusion of items more sensitive to the executive impairments prominent in many mental health conditions, as well as a more extensive examination of verbal memory (Moirand et al., 2018; Rosca et al., 2020). It was recommended by both Rosca et al (2020) and Yhang et al (2018) that, for people with schizophrenia, a lower cut-off (25/30) on the MoCA, may better discriminate cognitive impairment that requires more thorough examination through neuropsychological assessment.

Other tools that have been studied in the mental health context, include the ACE-III, which it was able to detect cognitive impairment in persons with schizophrenia (Charernboon & Chompookard, 2019) and the ACE-R which was effective in discriminating between persons with late life depression and those with Alzheimer's disease (Rotomskis et al., 2015). The NUCOG was also found to be an effective tool in detecting dementia in a neuropsychiatric population (Walterfang et al 2004). Finally, the ElectroConvulsive Therapy Cognitive Assessment (ECCA; Hermida et al., 2020), which was designed specifically to be sensitive to the types of deficits that occur with ECT (i.e. anterograde memory) was found to be superior to the MoCA in detecting cognitive impairment over the course of ECT treatment. However, it is of note for all of the above tools further validation is required, including further studies, larger sample sizes (Charernboon & Chompookard, 2019) and correlating outcome with performance on more extensive neuropsychological assessment (Charernboon & Chompookard, 2019; Hermida et al., 2020).

Older Person's Mental Health

The MoCA can be useful in an old age psychiatric setting to confirm normal cognitive functioning and to identify those who are in need for a specialized diagnostic pathway. It is valuable for confirming normal cognition (≥26, 95% sensitivity), excluding mild dementia (≥21; negative predictive value [NPV] 98%) and excluding MCI (greater than or equal to 26; NPV 94%) (Dautzenberg. G. 2019).

Using a cut-off score of 25 or less for both, the MoCA had a sensitivity of 97 % to detect dementia, with only 31% specificity, while the RUDAS had a 94% sensitivity to detect dementia, with 54% specificity. The MoCA at 25 or less had a sensitivity of 95% and a specificity of 69% to detect mild cognitive impairment, while the RUDAS at 25 had a sensitivity of 81% and a specificity of 88% to detect mild cognitive impairment. RUDAS score variation with educational attainment is significantly

smaller than MoCA score variation (P<0.01). The RUDAS is significantly briefer than the MoCA as a cognitive screening tool, and demonstrated similar sensitivity for dementia, with much better specificity for dementia and mild cognitive impairment, in an outpatient memory clinic (Brymer 2017). However, it should be noted that the validity of the use of the RUDAS within specific mental health conditions has yet to be explored in the research literature.

The MMSE is effective as a screening instrument to separate patients with cognitive impairment from those without it, however is limited in its detection of frontal lobe impairment (Royall et al., 1994; Slachevsky et al., 2004). A cut-off score of 25 on the MMSE yielded a sensitivity of 43.3% and a specificity of 90.4% for detecting CI. There is a ceiling effect with the MMSE, particularly with those of high pre-morbid intelligence.

The RUDAS has some advantages in its broad application, in that it does not require presence of an informant, and it does not include items that have potential to cause difficulties for some people with lower education levels or CALD background. The RUDAS compared favourably with the MMSE and did not appear to be influenced by language, education or gender. The RUDAS is at least as accurate as the MMSE, and does not appear to be influenced by language, education or gender (Jeffrey T. et al. 2006).

There is minimal research to identify any differences in the selection of the above cognitive screening tools used in older adult's mental health vs general older adults.

Neurology/Rehabilitation

The MoCA, MMSE and ACE III/ACE-R have been the most widely researched cognitive screening tools in the rehabilitation field. Across multiple studies, the MoCA has been shown to have better sensitivity compared to the MMSE, particularly in screening for mild cognitive impairment. It is recommended that the MMSE should only be used to screen for vascular dementia, as it has lower accuracy in identifying mild vascular cognitive impairment (Ghafar et al, 2018). In a study that looked at cognitive screening for patients with a CALD background, Emerson et al, (2019) suggested that the MoCA and RUDAS had comparable sensitivity (52% vs 57%) when the MoCA cut off score was lowered to 18. The MoCA has a lower specificity compared to the RUDAS, likely due to lower education levels in the study population.

In a systematic review of 16 different cognitive screens (including the MoCA and MMSE) Van Heugten et al (2014), determined that no instrument assesses all of the most commonly affected domains post stroke including speed of processing, memory, executive functioning and visuospatial abilities. Van Heugten et al (2014) suggested that, at the time of review, the MoCA was best placed to be used in the stroke population, however it should be accompanied by measures of speed of information processing.

Emerging research has indicated that the Oxford Cognitive Screen (OCS) should be considered as a cognitive screening tool post stroke as it can detect impairments such as neglect and apraxia, and deficits in reading, writing and number processing - impairments commonly seen post stroke and not specifically screened for by the MoCA or MMSE. It has a higher sensitivity compared to the MoCA (87% vs 78%) for detecting cognitive impairment in stroke patients (Demeyere et al 2016). Similarly, the OCS has a higher sensitivity and specificity in screening for cognitive impairment compared to the MMSE (Manusco et al, 2018).

Gaber et al (2011) suggests that the ACE-R language component has comparable sensitivity and specificity to other validated screening tools for aphasia following stroke. At a cut off value of 20/26, the ACE-R had a high sensitivity of 90% and specificity of 95%). Pendlebury et al (2012) found that the MoCA and ACE-R both had good sensitivity and specificity for mild cognitive impairment in patients with stable cerebrovascular disease (MoCA cut off score of <25 77% sensitivity and 83 % specificity, ACE-R <94 83% sensitivity and 73 % specificity). However, Lees et al (2017) determined that whilst the ACE III and MoCA both had good sensitivity (98%) they had variable specificity, because the accuracy of the test values depended on how any missing data was handled e.g. if the patient could not complete sections of the screen due to hand weakness, suggesting the need for further consensus around this issue.

If a MoCA is being used to screen for cognitive impairment in the stroke population, many studies recommend an adjustment of the cut off score, however there is yet to be a consensus on what this cut off score should be. Jaywant et al (2019) suggested a cut off score of 25/30 on the MoCA provided the optimal balance of sensitivity (72-87%) and specificity (60-81%) for identifying patients with mild or greater cognitive impairment particularly in those individuals with relatively high pre-morbid functioning. Shi et al (2018) suggests that the optimal cut off score for the MoCA differs in different stages of stroke and further research is needed to reach agreement on what the optimal cut off should be.

In reviewing the Cognistat, Nokelby et al (2008) suggested that the sensitivity for detecting cognitive deficits post stroke was 82%, however which cognitive domains are particularly affected should be concluded carefully. Shea et al (2017) determined that the Cognistat was particularly sensitive to identifying language (80% sensitivity) and memory (69% sensitivity) impairments post stroke. Overall, the Cognistat is more sensitive in identifying mild impairments compared to the MMSE, but performance on the Cognistat can also be influenced by age and education. In a small study, Lannin et al (2004) found that the Cognistat had the highest sensitivity (93%) compared to other measures including the BRISC, CAM and MMSE, but the combination of the Cognistat and the CAM may increase specificity, which is likely to be useful for rehabilitation. Lannin (2004) further suggested that the MMSE may not have adequate sensitivity to accurately screen for cognitive impairments with adults following acquired brain injury.

Aphasia

Aphasia is defined as a language disorder which can effect receptive language (understanding) and/or expressive language (output of language). Aphasia can be acute or chronic, may involve a cognitive element and can arise from stroke, neurodegenerative conditions, dementia or brain injury. People with aphasia may have alternate ways of communicating, for example, through gesture, written word, pictures, devices or they may need support with their communication. As a poor score on a cognitive screen for someone with aphasia may be due to their language deficit rather than cognitive impairment, results need to be interpreted carefully.

While the Oxford Cognitive Screen is inclusive for patients with neglect and aphasia and could be considered for use in this population, consultation with an individual's speech pathologist is recommended prior to any cognitive screening, as they will be able to provide specific information regarding the impact that the language deficit will likely have on their performance and how best to support the person with aphasia in accessing and completing the cognitive screen.

Functional assessments, such as Perceive, Recall, Plan, Perform System of Task Analysis (PRPP), may be more appropriate.

Traumatic Brain Injury

The NSW Health OT Cognitive Clinical practice guide recommends that cognitive screening and assessment is not completed with a patient who has sustained traumatic brain injury until the person is out of post traumatic amnesia (PTA) (NSW Health OT, 2020). PTA is the period of time during which a person is unable to lay down new memories following a head-injury (NSW ITIM, 2002). In NSW Health the Abbreviated Westmead PTA Scale (A-WPTAS) and Westmead PTA Scale are routinely used. The A-WPTAS is only for patients with current Glasgow Coma Scale of 13-15 (<24hrs post injury) with impact to the head resulting in confusion, disorientation, anterograde or retrograde amnesia, or brief loss of consciousness. Patient's with a head-injury not suitable for the A-WPTAS should be screened using the Westmead PTA Scale when the patient regains consciousness and can communicate intelligibly, verbal or non-verbal (Shores et al, 1986). Both screening tool require clinical judgments to be made by the administering clinician with regards to pre-existing conditions or other factors, such as effects of medications.

Persons who have emerged from coma and are in an unresponsive or minimal conscious state, it is recommended to use the following; Coma Recovery Scale-Revised, Wessex Head Injury Matrix, Western Neuro Sensory Stimulation Profile, or the Sensory Modalities and Rehabilitation Techniques.

It is advised that despite emergence from post-traumatic amnesia that ongoing cognition screening be completed especially when deficits continue to be present. Cognitive screens, such as the MOCA, RUDAS, Cognitive Assessment of Minnesota (CAM), ACE-III, MMSE, Oxford Cognitive Screen (OCS), Barry Rehabilitation Inpatient Screen of Cognition (BRISC), Contextual Memory Test (CMT), PRPP task analysis and MET should considered to further screen for the presence or absence of cognitive impairment. For people who have sustained an open head injury, the Orientation Log (O-Log) is recommended.

Alcohol and Other Drugs (AOD)

The MoCA has been the most widely studied cognitive screening tool in the AOD field. At the traditional cut score of <26, it has been shown to have good sensitivity (>80) and specificity (70%) in detecting cognitive impairment in patients with a range of substance use disorders, in both inpatient and outpatient treatment settings (Bruijnen et al., 2019; Copersino 2009; Ewart. 2018). Some studies have reported slightly lower sensitivity and specificity values at this cut-score (Pelettier, 2018; Ridley, 2018) but these remain acceptable (>70% for sensitivity and >60% for specificity). There is evidence for criterion validity (i.e. good correspondence between MoCA domain scores and performance on equivalent neuropsychological domains; Bruijnen 2018; Copersino, 2009) as well as predictive validity (i.e. a score can predict a clinically relevant behaviour or outcome). Specifically, treatment-seeking patients with SUD who had lower MoCA scores were less likely to attend treatment sessions (Copersino 2012) or drop out of treatment (Somhovd, 2019). There is also initial evidence that the MoCA is a useful tool to track changes in cognitive function in alcohol-dependent clients (e.g. over a rehabilitation admission; Pelletier, 2006).

Another cognitive tool that has initial evidence for suitability for use in the AOD field includes the Addenbrooke's Cognitive Examination (ACE-III, previously ACE-R). The ACE-R was shown to have good sensitivity (90%) and specificity (73%) in detection of cognitive impairment at a cut-score of <93 in a small outpatient study in Sydney (Ridley, 2018), and in another study has been shown to be able to differentiate between patients with alcohol-related brain damage and patients with alcohol dependence (Brown, 2019). The ACE-R has also been shown to be superior to the MMSE in identifying cognitive impairment in an older adult group attending AOD treatment (Lintzeris, 2016). However, more research is required to fully establish the suitability for the updated ACE-III across different patient groups and treatment types. This is also the case with other screening tools that have some initial evidence for use with this patient group but need further validation (e.g. the Neuropsychological Assessment Battery-Screening Module; Grohman 2004; the TEDCA (for alcohol users; Alvarez-Alonso 2017). The Frontal Assessment Battery may be able to detect some executive impairment in this cohort (Cuhna, 2010) however it does not provide a global measure of cognition or have a cut-score to guide use with AOD patients (Viswam, 2018)

The MMSE has reduced sensitivity to cognitive impairments seen in substance use disorders, and as a result may miss detecting clients with cognitive impairment (Oudman, 2014; Lintzeris 2016). This may be due to the limited inclusion of items assessing attention and executive functioning, which are commonly impacted in substance use disorders (Manning, 2016). It is not recommended as a tool for us with this patient group for this reason.

Practice Considerations When Working With Aboriginal or Torres Strait Islander Peoples

Aboriginal and Torres Strait Islander people have a much higher incidence of dementia, and from a younger age, compared to the remaining population. However, it may not be appropriate to complete standardised cognitive assessment (including screening) with First Nations' people. Indigenous psychologists have advocated that assessment of an Indigenous person should be "*wholistic; strength-based not deficit focused; involve family historians; and involves appraisal of the individual within the person's social and kinship network"* (see Working Together - http://aboriginal.telethonkids.org.au/media/699863/Working-Together-Book.pdf). Psychometric assessment, in many instances, may not be an appropriate means of measuring functioning and it is important that any cognitive screening conducted is culturally appropriate, and interpretation is within context.

The following principles should be applied when working with Aboriginal and/or Torres Strait Islander people:

- Any screening needs to occur in a culturally safe manner; your local Aboriginal Liaison Officer can be an excellent contact and resource.
- An understanding of the historical experience and how past events continue to impact on Indigenous Australians is crucial
- Take into account an individual's history, culture, language, customs, cultural values, expectations and life experiences in the knowledge that such issues will impact on the accuracy of measurement within the screening test.
- Remain mindful of the impact of any previous experiences such as trauma or displacement, and the effect it may have on the person's readiness to be assessed.

- Understand how westernised concepts (e.g., informed consent) and interpersonal communication styles (e.g., direct questioning, eye contact) may not be appropriate for working with some cultural groups.
- Reflect on any personal attitudes, values or biases that may have a bearing on the testing process

Before administering a cognitive screen, it is recommended that the following is considered:

- What is the purpose of the assessment? Does a formal screening tool need to be completed or would a functional cognitive assessment be more appropriate and provide more insight into how the person's cognition impacts upon their function?
- Consider asking family and community how the individual's cognition affects function during daily activities before formally assessing them
- It is important to build a level of trust and rapport with the person over a period of time and before conducting a cognitive screen – this could take days to weeks hence more functional tasks may be more appropriate
- Be mindful that the stress of an unfamiliar hospital environment will have an impact on performance. Consider whether it is possible to complete the cognitive screen in their own home or in a space that makes them feel comfortable.
- Consideration should be made for whether a person has received formal education. Consider whether it was western influenced and to what level this education was received. Talk to the person about their schooling experience to gain an understanding into their education before choosing a formal cognitive measure.

The Guddi Way (https://synapse.org.au/creating-real-change/our-research-work/research-projects/guddi-way/) is currently in development to offer a culturally relevant and appropriate process for identifying brain injury and complex disability (including co-occurring social and emotional wellbeing issues; trauma; alcohol and drug misuse; hearing loss; and social disadvantage) in Aboriginal and/or Torres Strait Islander peoples. The Guddi Way is underpinned by a 'yarning' method, which facilitates trust and relationship building and represents a culturally safe method of engagement (Bessarab & Ng'andu, 2010). Developed to support Aboriginal and Torres Strait Islander people to access the NDIS, the Guddi Way protocol has been piloted in multiple contexts including homeless services, Indigenous sentencing courts, and Indigenous community services (Somerville et al 2017). The Guddi Way includes culturally sensitive questions relating to cognition, thinking skills, disability and psychosocial functioning. Thinking and cognitive skills are measured across a number of cognitive domains including orientation, naming, verbal comprehension, verbal fluency, abstraction, recall, and executive function.

Section Two: Cognitive Screening Measures

1. Abbreviated Mental Test (AMT)
2. Addenbrooke's Cognitive Examination (ACE-III, ACE-R, ACE, Mini-ACE)
3. Allen's Cognitive Level Screen (ACLS)
4. Barry Rehabilitation Inpatient Screening of Cognition (BRISC)
5. Brief Cognitive Status Exam (BSCE)
6. Cognistat
7. Cognitive Assessment of Minnesota (CAM)
8. Kimberley Indigenous Cognitive Assessment (KICA)
9. Mini-Cog
10. Mini Mental State Examination (MMSE)
11. Modified Mini Mental State Test (3Ms)
12. Montreal Cognitive Assessment (MoCA)
13. Neuropsychiatry Unit Cognitive Screening Tool (NUCOG)
14. Oxford Cognitive Screen (OCS)
15. Rowland Universal Dementia Assessment Scale (RUDAS)
16. The Frontal Assessment Battery (FAB)

Abbreviated Mental Test

Author	Qureshi, K. and Hodkinson, M. (1974) Evaluation of a 10 question mental test of the institutionalized elderly. *Age and Ageing* 3: 152–157.
About	Developed by Geriatricians, It is a 10 question test used to rapidly assess elderly patients for delirium or dementia. Abbreviated version (AMT4) is included, along with Months Backward in the Rapid Assessment for Delirium (4AT). Validity data is limited and refers to correlation with the MMSE.
Administration	Administration time: 3-4 minutes Consists of 10 items Domains assessed: • Orientation • Registration • Recall • Concentration Cut-off score: 6 out of 10 or lower indicates possible dementia with a sensitivity of 0.81 and specificity of 0.84.
Considerations	Low positive predictive values mean a second stage assessment is **always** necessary. Tends to be culturally specific (validity impacted by use of questions such as date of WW1 and name of Monarch) and modified versions have not always been re-validated.
Training	No formal training available
References	Antonelli Incalze, R., Cesare, M., Pedone, C., Carosella, L. and Carbonin, P.U. (2003) Construct validity of the abbreviated mental test in older medical inpatients. *Dementia and Geriatric Cognitive Disorders* 15: 199–206. Hodkinson H. M. (1972) Evaluation of a mental test score for assessment of mental impairment in the elderly. *Age and Ageing*. 1(4):233-8. MacKenzie DM, Copp P, Shaw RJ, et al; (1996) Brief cognitive screening of the elderly: a comparison of the Mini-Mental State Examination (MMSE), Abbreviated Mental Test (AMT) and Mental Status Questionnaire (MSQ). *Psychological Medicine*. 26(2):427-30

Addenbrooke's Cognitive Examination (ACE-III, ACE-R, ACE)

Author	Hsieh, S., Shubert, S., Hoon, C., et al (2013) Validation of the Addenbrooke's Cognitive Examination III in Frontotemporal Dementia and Alzheimer's Disease. *Dementia and Geriatric Cognitive Disorders, 36*:242-250 Mioshi, E., Dawson, K., Mitchell, J et al (2006) The Addenbrooke's Cognitive Examination Revised (ACER_R): a brief cognitive test battery for dementia screening. *Journal of Geriatric Psychiatry, 21*:1078-1085 Mathuranath, P. S., Nestor, P. J., Berrios, G. E et al (2000) A brief cognitive test battery to differentiate Alzheimer's disease and fronto-temporal dementia. *Neurology, 55*: 1613-1620.
About	Aims to reliably detect early dementia in over 50 year olds with suspected dementia, particularly with those suspected with younger onset dementia, and to differentiate between different subtypes. Domains assessed: • Attention • Language • Visuo-spatial • Memory • Executive function Patients with Alzheimer dementia and fronto-temporal dementia have also shown significant differences in their performance on the different components of the ACE: orientation, attention, and memory were worse in Alzheimer patients, while the fluency with letters, language, and names were worse in patients with fronto-temporal dementia. The index study of the ACE-III demonstrated high sensitivity and specificity in detection of dementia (with cut-offs of 88/100; sensitivity =1.0; specificity =0.96, and 82/100; sensitivity =0.93; specificity =1.0). ACE-III domain scores (e.g. attention) have also been shown to correlate significantly with performance on neuropsychological tests assessing the same constructs. Normative sample consisted of 53 controls with mean age of 68 yrs.
Administration	Administration time: 15-20 mins 13 items Available in IPad version. Alternative forms available for repeat testing. Also available in Spanish, Italian, Chinese, Portuguese, Egyptian Arabic, and Thai Two optimal cut-off scores are recommended by the authors: - < 88/100 for higher sensitivity (less chance of missing cognitive impairment)

	- < 82/100 for higher specificity (less chance of false positives) Recommended cut-off score of < 76/100 for older adults >70 yrs (Cheung et al 2015) Forms and administration guidelines available from https://www.sydney.edu.au/brain-mind/resources-for-clinicians/dementia-test.html
Considerations	Good for distinguishing between normality, mild cognitive impairment and dementia, detecting dementia generally, including YOD and PDD. ACE has also been found to correlate with carer reports of functional impairment in most common dementias. Over-interpretation risks are high with this screening test because it takes longer to administer. Scores are based on people with an average age of 68 yrs – It should only be used with populations for which it has been properly validated. Avoid using it inappropriately i.e. TBI, younger patients A short version of the ACE has also been developed and validated in dementia patients (https://www.nzdementia.org/mini-ace). The Mini-Addenbrooke's Cognitive Examination (M-ACE) consists of 5 items with a maximum score of 30. Hsieh et al (2014) identified two cut-offs: 1) ≤25/30 has both high sensitivity and specificity and 2) ≤21/30 is almost certainly a score to have come from a dementia patient regardless of the clinical setting. It has been found to be superior to the MMSE and MoCA in diagnostic utility. It has not yet been validated for use in stroke, rehabilitation, psychiatry, neurology or D&A populations. A recent 2019 Cochrane meta-analysis recommended that the M-ACE should only be used as an adjunct to a full clinical assessment and not alone for the screening of dementia or mild cognitive impairment in patients presenting with or at risk for cognitive decline.
Training	Online training available for free : https://www.mvls.gla.ac.uk/aceiiitrainer/
References	Beishon, L. C., Batterham, A. P., Quinn, T. J., Nelson, C. P., Panerai, R. B., Robinson, T., & Haunton, V. J. (2019). Addenbrooke's Cognitive Examination III (ACE-III) and mini-ACE for the detection of dementia and mild cognitive impairment. *Cochrane Database of Systematic Reviews* Bruno, D., & Vignaga, S. S. (2019). Addenbrooke's cognitive examination III in the diagnosis of dementia: a critical review. *Neuropsychiatric Disease and Treatment*, *15*, 441 Cheung, G., Clugston, A., Croucher, M., et al (2015) Performance on three cognitive screening tools in a sample of older New Zealanders. *International Psychogeriatrics, 27*:981-989. Hsieh, S., McGrory, S., Leslie, F., Dawson, K., Ahmed, S., Butler, C. R... & Hodges, J. R. (2015). The Mini-Addenbrooke's Cognitive Examination: a new assessment tool for dementia. *Dementia and geriatric cognitive disorders*, *39*(1-2), 1-11 So M, Foxe D, Kumfor F, Murray C, Hsieh S, Savage G, Ahmed RM, Burrell JR, Hodges JR, Irish M, Piguet O (2018). Addenbrooke's Cognitive Examination III: Psychometric Characteristics and Relations to Functional Ability in Dementia. *Journal of the International Neuropsychological Society, 24(8), 854-863*

Allen's Cognitive Levels Screen (ACLS)

Author	ACLS – 5: Allen, C. K., Austin, S. L., David, S. K., Earhart, C. A., McCraith, D. B., & Riska-Williams, L. (2007). *Manual for the Allen Cognitive Level Screen-5 (ACLS-5) and Large Allen Cognitive Level Screen-5 (ACLS-5).* Camarillo, CA: ACLS and LACLS Committee
About	Developed as a functional cognitive screen for use in mental health settings to provide a quick estimate of an individual's learning and problem solving abilities during performance of three visual motor tasks of increasing complexity. It is not appropriate to use as a screening tool for dementia or other neurocognitive disorders. Scores are interpreted within the framework of the cognitive disabilities model (ACDM). The ACDM is a framework used for producing actions and activities that people with cognitive disabilities can be happily occupied completing. It consists of a range of testing activities including stitching, copying, colouring, and more. Limited information is available regarding the psychometric properties of the ACL-5. However, earlier versions were found to have moderate test-retest and inter-rater reliability and moderate criterion validity between the ACLS and ADL scores.
Administration	Administration time: 20 minutes Consists of three stitching tasks with a set of carefully designed, standardized activity demands and is for use with individuals whose cognitive abilities appear in the range of 3.0 to 5.8 on the Allen scale of cognitive levels. Scores range from 3.0 (low) to 5.8 (high). Two alternate forms available: the Large Allen Cognitive Level Screen (LACLS) for persons with vision or hand function problems, and the Disposable Large Allen Cognitive Level Screen (LACLS [D]) for single or serial use with individuals for whom infection control precautions must be observed.
Considerations	The ACLS is a functional cognitive screen that aims to connect cognitive ability to actions and activities a person is able to perform and the level of assistance a person requires in daily life. This screen is not intended for use in isolation or as a diagnostic tool and it is recommended that any strengths or problems that are identified be verified and supplemented with further assessment. There is a phone app available based around the Allen's Cognitive Disability Model (ACDM) which has an abundance of information suited to each level of functioning including affirmative activities, assistance required, and support considerations, and information processed. Unlike pen and paper based cognitive screening tools it does not provide a cut-off score for which further neuropsychological review of cognition is recommended. When having limited experience with administering the ACLS, it can be difficult to determine how to best utilise the outcome of the assessment to best support the individual

Training	Training required which can be time-intensive. https://www.acdmweb.com/
References	McAnanama, E. P., Rogosin-Rose, M. L., Scott, E. A., Joffe, R. T., & Kelner, M. (1999). Discharge planning in mental health: The relevance of cognition to community living. *American Journal of Occupational Therapy, 53*(2), 129-137. Roitman, D. M., & Katz, N. (1996). Predictive validity of the Large Allen Cognitive Levels Test (LACL) using the Allen Diagnostic Module (ADM) in an aged, non-disabled population. *Physical and Occupational Therapy in Geriatrics, 14*(4), 43-59. Velligan, D. I., Bow-Thomas, C. C., Mahurin, R., Miller, A., Dassori, A., & Erdely, F. (1998). Concurrent and predictive validity of the Allen Cognitive Levels Assessment. *Psychiatry Research, 80*(3), 287-298.

BRISC - Barry Rehabilitation Inpatient Screening of Cognition

Author	Barry, P., Clark, D. E., Yaguda, M., Higgins, G. E & Mangel, H. (1989) Rehabilitation Inpatient Screening of Early Cognitive Recovery. *Archives of Physical Medicine and Rehabilitation, 70*: 902 - 906
About	Short screening tool developed for use with recovering and cognitively impaired adults and to quantify change during recovery of brain injury. Domains assessed: • construction ability, • language, • memory, • mental flexibility, • orientation, • reasoning, • visual neglect. Normative data set – 20 brain-injured inpatient adults (age range 20 – 63 yrs, average was 33.4 yrs) and 52 people with no history of brain injury ranging in age 20-39 years High interrater reliability, along with good test-retest reliability ($r=0.962$, $p<0.01$) within one week period. BRISC also found to significantly correlate with the Mattis Dementia Rating Scale, Trail Making A & B, the Inpatient Memory Impairment Scale (IMIS) and Rappaport's Disability Rating Scale (DRS).
Administration	Administration Time: 20 – 30 minutes. Total score: 0 - 135 Nil cut-off as designed to monitor progress.
Considerations	Can be administered weekly to monitor for transient changes in cognitive deficits. Normed on people 20-39 yrs; Age - appropriate normative data is not available for comparison for the elderly population BRISC has a low ceiling - It is most appropriate for patients in the middle range of recovery and functioning and is sensitive to cognitive changes in a recovering brain-injured population undergoing intensive rehab It is not appropriate to use for screening for dementia or other cognitive conditions.
References	As above

Brief Cognitive Status Exam (BSCE)

Author	Wechsler, D. (2011) *Brief Cognitive Status Exam*. Pearson Clinical Assessment.
About	The Brief Cognitive Status Exam helps evaluate global cognitive functioning in patients with dementia, mild MR, TBI, or suspected Alzheimer's disease. UK explanation - helps evaluate global cognitive functioning in patients with suspected memory deficits or who are diagnosed with a wide range of neurological, psychiatric and developmental disorders. Including those with dementia, mild learning difficulties, or suspected Alzheimer's disease.) Domains assessed: • Orientation, • Time, • Mental Control, • Planning and Visual- Perceptual Processing, • Incidental Recall, • Inhibitory Control, • Verbal Productivity
Administration	Age Range: Individuals 17 to 90 years of age Administration Time: 15–20 minutes Designed to yield a performance classification focused on impaired rather than normal or superior performance (Average, Low Average, Borderline, Low, Very Low). The authors provide classification levels stratified by age and educational level.
Considerations	Copyrighted so need to purchase for use. Can purchase as a standalone test or is included as an optional module in the WMS-IV (Wechsler Memory Scale, Fourth Edition). Developed for use by clinical psychologists, medical professionals, and other mental health professionals in hospitals, mental health facilities, and assisted living facilities. BCSE has diagnostic utility as a cognitive screening measure in a mixed clinical sample and is more sensitive at detecting cognitive impairment, particularly milder levels, than the MMSE.
Training	Nil formal training, however purchase of BCSE requires minimum qualification as an allied health or special education professional
References	Hilsabeck, R. C., Holdnack, J. A., Cullum, C. M., Drozdick, L. W., Edelstein, B., Fiske, A., Lacritz, L., McCoy, K. J. M., & Wahlstrom, D. (2015). The Brief Cognitive Status Examination (BCSE): Comparing diagnostic utility and equating scores to the Mini-Mental State Examination (MMSE). *Archives of Clinical Neuropsychology*, *30*(5), 458-467.

Cognistat – Formerly Neuro-Behavioural Cognitive Status Examination

Author	Kiernan, R. J., Mueller, J., Langston, J.W., Van Dyke, C. (1987).The Neurobehavioural Cognitive Status Examination, a Brief but Differentiated Approach to Cognitive Assessment. *Annals of Internal Medicine. 107*. 481-485.
About	The Cognistat, formerly known as the Neurobehavioural Cognitive Status Examination (NSCE) is a cognitive test instrument. It screens for cognitive impairments in three general areas: • Attention • Orientation • Memory And five major ability areas: • Language • Constructional ability • Memory • Calculation skills • Executive skills The Cognistat is available in 3 different versions: • Cognistat Assessment System (CAS-II) – a web based, computer assisted format • Cognistat Paper – original pen and paper test • Cognistat Active Form – a computerised PDF format that does not require web access Cognistat's cognitive assessments have been standardised for adolescents, adults and for seniors in 3 age groups (60-64, 65-74 and 75-84). The Cognistat has been validated across a variety of areas - stroke, dementia, TBI, psychiatric disorders and substance abuse.
Administration	Administration time is approximately 15-20mins Performance is rated as average (no impairment), mildly impaired, moderately impaired or severely impaired in each of the ability areas. The Cognistat also asks the administrator to determine if any other factors are impacting on test performance e.g. visual or auditory impairments, learning disorder, anxiety/depression, second language etc. The Cognistat can be repeated – additional words for the memory item are included in the test kit.
Considerations	The Cognistat starter kit, test booklets or computer PDF formats need to be purchased online - https://www.cognistat.com/purchase-cognistat

	Most domains begin with a relatively difficult screening task – if the patient passes the screening question, the patient is presumed to function normally in that domain. If the patient fails the screening test, additional questions explore a possible deficit further. Some research papers have questioned the accuracy of this – the Cognistat may not be sensitive to mild or very subtle impairments (Nokelby et al, 2008). Advanced age is associated with diminished performance on construction, memory, similarities, attention and calculation domains. Lower education is also associated with diminished performance. It is recommended that interpretation of performance in older adults and those with lower education be done with caution (Shea et al, 2017)
Training	Nil formal training is required to administer the test, any trained health care professional is able to describe an individual's test performance as falling within the average range or mild, moderate or severe range of impairment on any of the specific subtests. It is suggested that medical or psychological training is required to determine the diagnostic significance of the test results. There are instructional videos available online https://www.cognistat.com/
References	Kiernan, R. J., Mueller, J., Langston, J.W., Van Dyke, C. (1987).The Neurobehavioural Cognitive Status Examination, a Brief but Differentiated Approach to Cognitive Assessment. *Annals of Internal Medicine. 107*. 481-485. Shea, T., Kane, C., & Mickens M. (2017). A Review of the Psychometric Properties of the Cognistat/Neurobehavioural Cognitive Status Examination in Adults Post-Cerebrovascular Accident. *Rehabilitation Psychology. 62*(2). 221-222.

Cognitive Assessment of Minnesota (CAM)

Author	Rustad, R.A., DeGroot, T.L., Jungkunz, M. L., Freeberg, K.S., Borowick, L.G., & Wanttie, A.M. (1993). *The Cognitive Assessment of Minnesota.* Tucson: Therapy Skill Builders.
About	The CAM is a standardised test which measures the cognitive abilities of adults with neurologic impairment (ABI). It covers a variety of cognitive skills which are organized into a hierarchy from simple to complex. In order to perform higher level cognitive functions, the more basic functions must first be achieved. The hierarchy is divided into four areas: store of knowledge, manipulation of old knowledge, social awareness and judgment, and abstract thinking. Developed by OT's, functional tasks and outcomes are emphasised. The CAM not only provides a global measure of cognition but also assesses practical skill domains (for example, the CAM allows for assessments of working memory and simple mathematical ability (e.g., can the person make change) that would allow for specific recommendations (e.g., providing assistance to the affected person in managing finances). Domains assessed: • attention span, • memory orientation, • visual neglect, • temporal awareness, • safety and judgement, • recall/ recognition, auditory memory and sequencing, • simple math skills CAM has strong inter-rater reliability (94%) and test-retest reliability (96%), along with 95% specificity to correctly classify patients with & without cognitive impairment Also has good concurrent validity for level of impairment when compared against professional clinical judgment by occupational therapists
Administration	Copyrighted so need to purchase for use. Administration time: 35-45 minutes 29 Items, scored as either 3= mild to no impairment, 2=moderate impairment, 1=severe impairment, or 2=intact, 1=impaired. Scoring range: 0-80 Scoring categories range from: None - Mild: 52-80 Moderate: 30-51 Severe deficit: 0-29

Considerations	CAM includes assessment for impairment in money management, social awareness and planning ability, unique to the CAM and not included in BRISC OR MMSE Not an appropriate screen for individuals with visual-perceptual-motor or visual acuity deficits or aphasia.
Training	Nil formal training, however purchase requires minimum qualification as an allied health or special education professional
References	Lannin, N. A & Scarcia, M., (2004) Multidisciplinary screening of cognitive impairment following acquired brain injury: Is there Repetition? *Journal of Cognitive Rehabilitation*, *23*(1): 19-25. Feick, D., Sickmond, J., Liu, L., Metellus, P., Williams, M., Rigamonti, D., & Hill-Briggs, F. (2008). Sensitivity and predictive value of occupational and physical therapy assessments in the functional evaluation of patients with suspected normal pressure hydrocephalus. *Journal of Rehabilitation Medicine*, *40*(9), 715-720. https://doi.org/10.2340/16501977-0241 Feliciano, L., Baker, J. C., Anderson, S. L., LeBlanc, L. A., & Orchanian, D. M. (2011). Concurrent validity of the Cognitive Assessment of Minnesota in older adults with and without depressive symptoms. *Journal of Aging Research*, *2011*.

Kimberley Indigenous Cognitive Assessment Tool (KICA)

Author	LoGiudice D, Smith K, Thomas J, Lautenschlager N, Almeida O, Atkinson D, et al. (2006) Kimberley Indigenous Cognitive Assessment tool (KICA): development of a cognitive assessment tool for older Indigenous Australians. *International Psychogeriatrics. 18*(2):269-280.
About	This assessment tool was developed with Aboriginal and Torres Strait Islander health and aged care organisations in the Kimberley, WA and comprises cognitive, informant and functional sections. It was developed to assess for dementia in older Aboriginal Australians (45 years +) living in rural and remote areas. Domains assessed: - Orientation - Free and cued recall - Language - Verbal fluency - Copying - Sequence pattern - Ideational praxis The test is validated for Aboriginal and Torres Strait Islander peoples over 45 years of age.
Administration	*http://www.wacha.org.au/kica.html* A cut-off score of <33 out of 39 may indicate that the person being tested could be suffering from dementia
Considerations	Many test questions rely on the use of culturally appropriate pictures requiring adequate vision, and commonly found objects (i.e. matches, comb and pannikin cup) were used. When using such tests, it is important to consider the person being tested in the context of their prior education and abilities, as well as geographical differences. As an example, it may be quite appropriate to consider the use of the standard Mini Mental State Examination to assess cognitive impairment in an Aboriginal or Torres Strait Islander university academic residing in an urban area, whereas the KICA may be more appropriate to assess cognitive impairment in an Aboriginal and Torres Strait Islander person with pre-existing limited education and language skills, originally from a remote area.
Training	Nil formal, but instruction book available at https://www.dementia.org.au/sites/default/files/20120821_KICA_Instruction_Booklet.pdf
References	Dingwall KM, Cairney S. (2010) Psychological and cognitive assessment of Indigenous Australians. *Australian and New Zealand Journal of Psychiatry; 44*(1):20-30. Dudgeon, P., Milroy, H. & Walker, R. (2014) *Working Together: Aboriginal and Torres Strait Islander Mental Health and Wellbeing Principles and Practice. Second Edition*. **https://www.telethonkids.org.au/globalassets/media/documents/aboriginal-health/working-together-second-edition/working-together-aboriginal-and-wellbeing-2014.pdf**

Mini-Cog

Author	Borson, S., Scanlan, J., Brush, M., Vitaliano, P., & Dokmak, A. (2000). The Mini-Cog: A cognitive "vital signs" measure for dementia screening in multi-lingual elderly. *International Journal of Geriatric Psychiatry, 15(11),* 1021-1027.
About	The Mini-Cog was designed to be a brief screening test to identify dementia and that was suitable for use with people from culturally and linguistically diverse backgrounds, as well as those with limited education. It was validated with 249 older adults with diverse cultural and linguistic backgrounds (only half spoke English as their primary language) Sensitivity of 99% and Specificity of 93% was found for detecting dementia within this population. However, the sensitivity (76%) and specificity (89%) was found to be more limited when used in a more random sample of the population
Administration	Administration time: 2-4 mins Consists of three components; 1. repetition of 3 unrelated words, 2. a clock drawing task, and 3. recall of the three words. The word recall and clock drawing task are used for scoring purposes. Alternative scoring methods are available. Using Borson et al (2005) scoring method, a score of 2 out of 5 or lower indicates a high likelihood of dementia. The Mini-Cog is available in multiple languages.
Considerations	Minimal bias due to language and education makes it particularly suitable for use when screening for dementia with non-English speaking individuals or those with limited education. However has limited sensitivity in general population. The clock drawing task may challenge individuals lacking regular exposure to analog clocks. While the Mini-Cog has been used with a wide range of cultural groups, all populations were based in the US.
Training	No formal training required, Instructions included on scoring form.
References	Borson, S., Scanlan, J. M., Chen, P., & Ganguli, M. (2003). The Mini-Cog as a screen for dementia: Validation in a populations-based sample. *Journal of the American Geriatrics Society, 51(10)*, 1451 – 1454.

Mini-Mental State Examination (MMSE)

Author	Folstein, M. F., Folstein, S. E. & McHugh, P. R. (1975). Mini-Mental state: A practical method for grading the state of patients for the clinician. *Journal of Psychiatric Research, (12)*:189-198.
About	Developed as a brief and objective bedside screening tool for people with delirium or dementia who may only be able to cooperate for short periods of time, in order to provide a quantitative evaluation of cognitive impairment and to record cognitive changes over time. Domains assessed: • Orientation, • Registration and recall, • Attention, • Language • Construction • Calculation Using a cut-off score of ≤24 to indicate dementia; - sensitivity of <85% and specificity of <98% in community populations - sensitivity of 71% and specificity of 95.6% in hospitalised patients - sensitivity of 84.9% and specificity of 60.8% in memory clinics Note that the sensitivity decreases for younger-onset dementias High test-retest reliability, internal consistency and high inter-observer reliability.
Administration	Administration takes approx. 10 mins 11 items Total score ranges from 0 – 30, with higher scores indicating better performance. Scoring: • 27-30 = Normal range • 21-26 = Mild Cognitive Impairment • 11 – 20 = Moderate cognitive impairment • 0 – 10 = Severe cognitive impairment Patient-specific norms taking into account age and educational level available (Crum, Anthony, Bassett, & Folstein, 1993).

	While the MMSE is copyrighted – Australia holds a national license and so it is free to use. Guidelines on administration and scoring of a standardised version of the MMSE can be found at https://www.ihpa.gov.au/sites/default/files/publications/smmse-guidelines-v2.pdf
Considerations	While the measure was originally used to detect dementia within a psychiatric setting, its use has become widespread. However, psychometric studies suggest that their use in an unselected elderly populations is not recommended as the tests are likely to produce more false positives than true cases of dementia. It is available in many different languages; Chinese, Danish, Finnish, Fr4nch, German, Greek, Hebrew, Hindi, Italian, Japanese, Korean, Norwegian, Polish, Portuguese, Russian, Spanish and Swedish. Susceptible to age, education, literacy, socioeconomic and cultural differences, along with insensitivity to mild, severe and/or focal impairments. Folstein, Folstein, and McHugh (1975) found that the MMSE demonstrates marked ceiling effects in younger intact individuals and marked floor effects in individuals with moderate to severe cognitive impairment. It is not suitable for use with Aboriginal or Torres Strait Islander peoples and NESB populations. It also does not appear to have adequate sensitivity to adequately screen for cognitive impairments in adults following acquired brain injury or other conditions such as multiple sclerosis or substance use-related cognitive impairments. Repeated use of the MMSE with the same client reduces its validity, so it is advised that this screening tool not be used repeatedly with the same individual if the time interval between testing is short.
Training	Guidelines on administration and scoring of a standardised version of the MMSE can be found at https://www.ihpa.gov.au/sites/default/files/publications/smmse-guidelines-v2.pdf
References	Flicker L, Logiudice D, Carlin JB, Ames D. The predictive value of dementia screening instruments in clinical populations. *International Journal of Geriatric Psychiatry*. 1997;12(2):203–209 Folstein, M. F., Folstein, S. E. & Fanjiang, G. (2000). *MMSE: Mini-Mental State Examination. Clinical Guide*. Lutz, FL: Psychological Assessment Resources. Lannin, N. A & Scarcia, M., (2004) Multidisciplinary screening of cognitive impairment following acquired brain injury: Is there Repetition? *Journal of Cognitive Rehabilitation.* MacKenzie DM, Copp P, Shaw RJ, and Goodwin GM. Brief cognitive screening of the elderly: a comparison of the Mini-Mental State Examination (MMSE), Abbreviated Mental Test (AMT) and Mental Status Questionnaire (MSQ). *Psychol Med*. 1996;26(2):427-430. Mitchell AJ. A meta-analysis of the accuracy of the mini-mental state examination in the detection of dementia and mild cognitive impairment. *Journal of Psychiatric Research*. 2009;43(4):411–431. Srikanth V, Thrift AG, Fryer JL, Saling MM, Dewey HM, Sturm JW, Donnan GA (2006) The validity of brief screening cognitive instruments in the diagnosis of cognitive impairment and dementia after first-ever stroke. *Int Psychogeriatr.18*(2):295-305.

Modified Mini-Mental State Test (3Ms)

Author	Teng, E. L. & Chui, H. C. (1987) The Modified Mini-Mental State (3MS) Examination. *Journal of Clinical Psychiatry, (48*): 314 - 318
About	3Ms was developed to extend the scope of the MMSE to improve discrimination among different levels of dementia. It includes four additional items (on long-term memory, abstract thinking, category fluency, delayed recall) to the MMSE. Domains assessed: • Attention/ concentration, • orientation to time and place, • long-term and short-term memory, • language ability, • constructional praxis, • abstract thinking, and • list-generating fluency. It may be used as a screening test for cognitive loss or as a brief bedside cognitive assessment.
Administration	Administration time: 10 – 15 mins. Total score range of 1–100 with higher score indicating better performance. Standardized cut-off point of <80 for the presence of cognitive impairment.
Considerations	A correlation of 0.82 has been reported between telephone and in-person administrations. A scoring method that compensates for sensory impairments and adjusts for educational level has been proposed by Khachaturian et al (2000). Better validity than MMSE. Susceptible to educational and age bias Grace et al. (1995) found that 3MS was a significantly better predictor of functional outcome (as measured by FIM scores) in geriatric patients post-stroke than the MMSE, with higher sensitivity (69% vs. 44%) and similar specificity (80% vs. 79%). 3MS + Clock-drawing (Suhr & Grace, 1999) - The addition of clock drawing, a simple measure of constructional ability, increased the sensitivity of the 3MS in detecting focal brain damage in patients with right hemisphere stroke (87%). The addition of the Clock Drawing Test requires about two extra minutes in administration time.
References	Grace J, Nadler JD, White DA, Guilmette TJ, Giuliano AJ, Monsch AU. Snow MG. (1995) Folstein vs Modified Mini-Mental State Examination in geriatric stroke: stability, validity, and screening utility. *Archives of Neurology 52*:477-84. Suhr JA, Grace J. (1999) Brief cognitive screening of right hemisphere stroke: relation to functional outcome*. Archives of Physical Medicine and Rehabilitation;80*:773-6.

Montreal Cognitive Assessment (MoCA)

Author	Nassreddine, Z. S., Phillips, N. A., Bedirian, V., Charbonneau, S., Whitehead, V., Collin, I., Cummings, J. L. and Chertkow, H. (2005). The Montreal cognitive assessment, MoCA: A brief screening tool for mild cognitive impairment. *Journal of American Geriatrics Society; 53*: 695 – 699.
About	Initially developed to identify mild cognitive impairment (MCI) in older adults but now validated for a wide range of patient populations. It was designed for use with people who performed in the normal range on other screening instruments, such as the MMSE, yet complained of mild cognitive difficulties. Nasreddine et al (2005) defined MCI as "an intermediate clinical state between normal cognitive aging and dementia, and it precedes and leads to dementia in many cases… " Domains assessed: • Attention, concentration and working memory • Orientation to time and place • Language • Short term memory • Visuospatial abilities • Executive functions Adequate test-retest reliability Excellent sensitivity of 90% in detecting MCI and 100% in detecting mild Alzheimer's Disease and good specificity of 87% in detecting normal controls.
Administration	Administration time is approx 10 minutes. iPad administration also available. Total score out of 30. When the total score is less than 30, 1 point is added to the total score for respondents with less than 12 years of education. Cut-off score of <26 out of 30 indicates mild cognitive impairment Better to use cut-off score of 20 out of 30 for older adults >70 yrs (Cheung et al 2015) Developers suggest a cut-off score of 18 could be considered to separate MCI from AD but acknowledge there is overlap in the scores since, by definition, AD is determined by the presence of cognitive impairment in addition to loss of autonomy. The average MoCA score for MCI is 22 (range 19-25) and the average MoCA score for Mild AD is 16 (11-21). MoCA forms are available in NSW Health State Forms. Available in multiple different languages which can be downloaded from https://www.mocatest.org/ Two alternative version in English also available to enable reliable test-retesting.
Considerations	Widely used and validated for a range of patient populations.

	Increased emphasis on executive functioning and attention than the MMSE (better at detecting PD dementia, cognitive impairment in substance use). Normative data stratified by age and educational level (ages 18-85) available from Rosetti et al (2011) in an American sample found the recommended cut-off scores were generally lower than those proposed by the authors.
Training	From the 1st September 2020, the developers of the MoCA have said training and certification to administer and score the MoCA Test is mandatory, with exemptions for neuropsychologists and students, residents and fellow supervised by an accredited health professional. This certification is valid for two years (retraining after two years is recommended not mandatory). You can complete the online training and certification process at https://www.mocatest.org/ for a small fee.
References	Rossetti, H. C., Lacritz, L. H., Cullum, C. M., & Weiner, M. F. (2011). Normative data for the Montreal Cognitive Assessment (MoCA) in a population-based sample. *Neurology*, *77*(13), 1272-1275.

Neuropsychiatry Unit Cognitive Assessment (NUCOG)

Author	Walterfang M, Siu R, Velakoulis D. (2006). The NUCOG: validity and reliability of a brief cognitive screening tool in neuropsychiatric patients. *Australian and New Zealand Journal of Psychiatry*. *40*(11-12), 995-1002.
About	Initially developed at Royal Melbourne Hospital to identify cognitive impairment in patients of their neuropsychiatric service. It can be used to screen for cognitive impairment when there is suspected cognitive and/or adaptive functional decline, to assess baseline cognitive functioning and to monitor cognitive response to treatment interventions. Domains assessed: • Attention • Memory • Language • Visuospatial abilities • Executive functions The tool was validated in a population with three diagnostic groups [dementia (n = 65); neurological disorders not presenting with dementia (n = 44); and psychiatric illness (n = 156)] and a healthy control group, with all participants over 18 yrs. The NUCOG differentiated the four broad groups and the dementia subgroups more strongly than the MMSE. At a cut-off score of 80/100, sensitivity of the NUCOG for detection of dementia was 0.84 and specificity 0.86. At this cut-off point of 80, the positive predictive value was 0.82, the negative predictive value was 0.79, and the false positive rate was 0.05. Internal consistency was high (0.915). Scores were significantly affected by age and years of education. Psychometric properties were reviewed as "average" in a systematic review (De Roeck et al 2019) and not preferred for detection of mild cognitive impairment and AD dementia over the MoCA.
Administration	Administration time is approximately 15-20 minutes. It has 21 items. Each cognitive domain is scored out of 20 possible points, yielding a maximum NUCOG score of 100. In the appropriate clinical context, a total score of 80 or less is suggestive of cognitive impairment with sensitivity of 0.84 and specificity of 0.86 for detection of dementia. A score of greater than 80 but with scores 16 or less on two or more domains is also suggestive of cognitive impairment. The NUCOG is available in English, Spanish, Portuguese, Malay, Uyghur and simplified Chinese versions. A Chinese version of the NUCOG has been validated in patients with epilepsy, dementia and other neurological disorders. The NUCOG can be used and administered by psychiatrists, psychologists, occupational therapists, psychiatric nurses and medical practitioners.
Considerations	The tool can be purchased (e.g., ACER: $164.95). A free version for iPad can be downloaded: https://download.cnet.com/NuCog/3000-2129_4-76944870.html

	The manual notes that the NUCOG should not be used for diagnostic purposes and results should be integrated with data from all available sources, including the patient and carer history, further cognitive and neuropsychological assessment, the physical examination and investigation results.
Training	A video of the NUCOG in practice can be found at the Orygen site: https://www.orygen.org.au/Training/Resources/Cognition/Videos/NUCOG-in-practice
References	De Roeck, E. E., De Deyn, P. P., Dierckx, E., & Engelborghs, S. (2019). Brief cognitive screening instruments for early detection of Alzheimer's disease: a systematic review. *Alzheimer's research & therapy, 11*(1), 21. Gao, S., Li, S-C., Xia, L., Pan, S., Velakoulis, D., & Walterfang, M. (2014). Validation of the Chinese version of the NUCOG cognitive screening tool in patients with epilepsy, dementia and other neurological disorders. *Journal of Clinical Neuroscience, 21*(6), 980-987.

Rowland Universal Dementia Assessment Scale (RUDAS)

Author	Storey, J. E., Rowland, J. T. J., Conforti, D. A. & Dickson, H. G. (2004). The Rowland Universal Dementia Assessment Scale (RUDAS): A multicultural cognitive assessment scale. *International Psychogeriatrics, 16*: 13-31.
About	Designed in Australia to be suitable to be used with people from non-English speaking backgrounds and to minimise the effects of cultural learning and language diversity on the assessment of baseline cognitive performance. Domains assessed: • Memory • Praxis • Language • Judgement • Visuoconstruction • Body orientation Using a cut-off score of <23 to differentiate between dementia vs non-dementia, sensitivity was found to be 81% and specificity 98%. Excellent inter-rater (r=0.99) and test-retest (r = 0.98 at one week) reliabilities
Administration	Administration takes 10 mins 6 items Cut-off score <23 out of 30 indicates likely cognitive impairment. (although a cut-off of 25 out of 30 suggested by Nielson et al 2018) Cur-off of 22/30 for >70+ yo (Cheung et al 2015)
Considerations	Not especially affected by gender, education, preferred language, less clear about influence of age (has not been validated in adults <50 years of age).
Training	For training: a DVD and guidelines are available at http://www.alzheimers.org.au/understanding-dementia/rowland-universal-dementia-assessment-scale.aspx
References	Rowland, J. T., Basic, D., Storey, J. E., & Conforti, D. (2006) The Rowland Universal Dementia Assessment Scale (RUDAS) and the Folstein MMSE in a multicultural cohort of elderly persons. *International Psychogeriatrics*. *18*: 1–10.

Oxford Cognitive Screen

Author	Demeyere N, Riddoch MJ, Slavkova ED, Bickerton W-L, & Humphreys GW. (2015). The Oxford Cognitive Screen (OCS): Validation of a stroke-specific short cognitive screening tool. *Psychological Assessment*, *27*(3), 883–894.
About	The OCS is a brief, domain-specific screening tool designed for stroke specific deficits and to be aphasia & neglect friendly. Domains assessed: • Attention. • Language • Praxis • Number • Memory The OCS, as a domain-specific cognitive screen results in a cognitive profile, highlighting areas of impairment as well as preserved cognitive abilities to give a more informative outcome than an overall 'cognition pass/fail'. The OCS has been found to detect higher incidences of stroke-specific cognitive impairments, not detected by the MMSE, demonstrating the importance of cognitive profiling. It is scored against a normative data set of 140 neurologically intact participants between the ages of 36-88. Average age 65 years, average length of education 13.9 years. 58.6 % were females.
Administration	10 items There is no overall score, rather each domain is scored separately It has been translated and normed into other languages and other cultural adaptions are underway (US, Greek and German) There is a parallel Version B available for repeat testing and a Version C may also be developed.
Considerations	Designed specifically for use in a stroke population - Inclusive for patients with aphasia and neglect. Limited ability to pick up on mild cognitive impairment. (The OCS-Plus (for mild cognitive impairment) is currently in the norming stage) Limited testing of executive functioning - only trail making with shapes It is free, but is licensed in order to track uptake
Training	Whilst training isn't required to administer, staff administering the test are encouraged to watch the instructional video and read the manual https://nswhealth.sharepoint.com/sites/StrokeNetwork-ACI/OxfordCognitiveScale?e=1%3Adefb8531fff74844942519f2dcac19f4 or http://www.ocs-test.org/?page_id=13

References	Mancuso M, Demeyere N, Abbruzzese L, Damora A, … & Zoccolotti P. (2018) Using the Oxford Cognitive Screen (OCS) to detect cognitive impairment in stroke patients: a comparison with the mini-mental state examination. *Frontiers Neurology*

The Frontal Assessment Battery (FAB)

Author	Dubois, B., Slachevsky, A., Litvan, I., Pillon, B. (2000) The FAB: A frontal assessment battery at bedside. *Neurology*, *55*: 1621-1626
About	Designed as a brief tool to be used at bedside or in clinical settings to assess executive functioning. It was also designed to assist discrimination between Alzheimer's disease and dementias with a frontal dysexecutive phenotype. Domains assessed: • Conceptualisation/ abstract reasoning • Mental flexibility • Motor programming • Sensitivity to interference • Inhibitory control • Environmental autonomy Standardised with 42 normal subjects and 121 patients with various degrees of frontal lobe dysfunction (Parkinson's disease, multiple system atrophy, corticobasal degeneration, progressive supranuclear palsy and frontotemporal dementia). Internal consistency (0.78) Interrater reliability (0.87) Normative data is available from an Italian sample (Appollonio et al, 2005) using a sample of 364 healthy adults aged 50 – 94 years.
Administration	Administration takes approx. 10 minutes 17 items Total score ranges from 0 to 18, with lower scores indicating poorer performance. Various cut-off points have been suggested: • < 12 – distinguish between frontotemporal lobe dementia and early Alzheimer's disease (sensitivity 77%, Specificity 87%, Slachevsky et al 2004) • < 14 – distinguish between progressive supranuclear palsy and multisystem atrophy or Parkinson's disease (Sensitivity and specificity 78%, Paviour et al 2005).
Considerations	Explores cognitive and behavioural domains significantly correlated with frontal lobe metabolic activity High correlation between FAB and other tests sensitive to frontal lobe functions. No correlation between MMSE and FAB

	Nakaaki et al (2008) found apathy or depression may also reduce performance so need to consider if these are present when scoring and interpreting results. Test-retest reliability not known
References	Appollonio, I., Leone, M., Isella, V., Piamarta, F., Consoli, T., Villa, M. L., et al (2005). The Frontal Assessment Battery (FAB): Normative values in an Italian population sample. *Neurological Sciences, 26*(2): 108-116. Moreira, H. S., Costa, A. S., Castro, S. L., Lima, C. F., & Vicente, S. G. (2017). Assessing executive dysfunction in neurodegenerative disorders: a critical review of brief neuropsychological tools. *Frontiers in aging neuroscience, 9*, 369. Nakaaki, S., Murata, Y., Sato, J., Shinagawa, Y., Hongo, j., Tatsumi, H., Hirono, N., Mimura, M. & Furukawa, T. A. (2008) Association between apathy/depression and executive function in patients with Alzheimer's disease. *International Psychogeriatrics. 20*(5): 964-975. Paviour, D. C., Winterburn, D., Simmonds, S., Burgess, G., Wilkinson, L., Fox, N. C., ... & Jahanshahi, M. (2005). Can the frontal assessment battery (FAB) differentiate bradykinetic rigid syndromes? Relation of the FAB to formal neuropsychological testing. *Neurocase, 11*(4), 274-282. Slachevsky, A., Villalpando, J. M., Sarazin, M., Hahn-Barma, V., Pillon, B. & Dubois, B. (2004). Frontal Assessment Battery and differential diagnosis of frontotemporal dementia and Alzheimer Disease. *Archives of Neurology, 61*(7): 1104-1107.

Appendix – Summary of Studies

Older Adults

Study	Screening Measure/s	Population (e.g. diagnosis, inpatient, outpatient)	Mean age (SD; range)	Main findings
Bruno (2019) *Argentina*	ACE-III M-ACE	Critical review	n/a	ACE-III sub-components of orientation, attention and memory sub-components show lower scores in Alzheimer patients, whilst fluency with letters, language and names were lower in people with frontotemporal dementia. The M-ACE cut-off score ≤21/30 is almost certain to be a score come from person with dementia regardless of the clinical setting and has been found to be superior to the MMSE and MoCA in diagnostic utility. ACE-III can differentiate patients with and without cognitive impairment, sensitive to the early stages of dementia and available in 19 different languages and localized for users in Australia, India, The United States, The United Kingdom and New Zealand. Further research is needed to obtain optimal cut-offs and different versions and to evaluate the impact of different age, gender, IQ and education variables on the performance of the test.
Cheung (2015) *NZ*	ACE-III MoCA RUDAS	≤ 65 years old 37 participants with mild dementia (MMSE ≥20 with diagnosis), 47 participants without dementia (MMSE ≥24 with intact cognition as per geriatrician) New Zealand population group	Mild dementia mean age 77.4 Control mean age 79.7	All three tools discriminated well overall between cases of mild dementia and controls. The three tests were strongly correlated 0.85 between ACE-III and MoCA, 0.70 between ACE-III and RUDAS and 0.65 between MoCA and RUDAS. The study results derived optimal cut-off points as lower than published recommendations for older age groups ACE-III optimal cut-off 76/100, sensitivity= 81.1%, specificity= 85.1%) and the MoCA 20/30, sensitivity= 78.4%, specificity= 83.0%), but similar for the RUDAS 22/30, sensitivity= 78.4%, specificity= 85.1% compared to cut off 23/30. The RUDAS correlates well with the MMSE in predicting cognitive impairment. The RUDAS is less influenced by language and education than the MMSE.
Custodio (2020) *Peru*	RUDAS	187 controls n = 60; MCI n = 64; dementia n = 63	≥60	The Peruvian version of the RUDAS (RUDAS-PE) was used in discriminating between controls, patients with MCI and dementia in an illiterate elderly population (illiterate persons of at least 15 years old with (< 1 full year of formal education completed and inability to read or write). The area under the ROC curve for the RUDAS to discriminate dementia from MCI was 98.0% with an optimal cut-off <19 (sensitivity 95%, specificity 97%); whereas, to differentiate MCI and controls was 98.0% with an optimal cut-off <23 (sensitivity 89%, specificity 93%). The RUDAS-PE was suitable to aid detection of dementia in geriatric illiterate population with low-levels of education.
D'Onofrio (2018) *Italy*	FAB	215 in-patients (115 Alzheimer's dementia (AD) and 100 Vascular dementia (VaD) patients)	≥65	This study looked at consecutively evaluating FAB and a Comprehensive Geriatric assessment in terms of detecting executive dysfunction amongst patients with AD and VaD. The prevalence of dysexecutive syndrome screened with a FAB score ≤12 points was high in both AD (97

				patients=84.3%) and VaD (77 patients= 77.0%). AD patients shower a significantly higher impairment in FAB total score and five FAB subtests (conceptualization, motor programming and sensitivity to interference, inhibitory control and environmental autonomy) than VaD patients. Executive dysfunction could be greater in AD patients with moderate to severe dementia compared to VaD patients, though these groups were not matched for age, comorbidity or polypharmacy.
Hsieh (2013) *Australia*	ACE-III ACE-R	61 participants- Frontotemporal dementia FTD n=33, Alzheimer's disease AD n=28 and 25 controls	Mean= 66.0 SD= 6.25	ACE-III cognitive domains correlated significantly with standardized neuropsychological tests used in the assessment of attention, language, verbal memory and visuospatial function. The ACE-III also compared favorable with its predecessor the ACE-R with similar levels of sensitivity= 1.0 and 0.93 and specificity=0.96 and 1.0 for cut-off scores 88/100 (clinical) and 82/100 (research). ACE-III maintains as a valid cognitive screening tool in distinguishing between dementia syndromes FTD and AD.
Larner (2020) *Canada*	Mini-ACE	287 ≥ 65 years old 119 ≥ 75 years Out-patients seen in neurology clinic	≥ 65 ≥ 75	Various test accuracy metrics were examined at two Mini-ACE cut-offs (≤ 25/30 and ≤ 21/30), comparing a whole patient cohort with those aged ≥ 65 or ≥ 75 years. Dependent upon the chosen cut-off, Mini-ACE was either very sensitive or very specific for the identification of any cognitive impairment in the older patient cohorts with increased disease prevalence. The ≤ 25/30 cut-off has greater sensitivity (0.963 ≥65 year olds, 0.991 ≥75 year olds) inevitably with more false positives, and ≤ 21/30 has greater specificity (0.944 ≥65 year olds, 0.875 ≤75 year olds) inevitably with more false negatives, At both cut-offs the positive predictive values and post-test odds increased in the older patient cohorts. Mini-ACE is a valid instrument for identification of cognitive impairment in older people however further studies of MACE are required as there is no definite comment made about test utility for patients ≤75 years old.
Matias-Guiu (2017) *Spain*	ACE-III MIS MMSE MoCA RUDAS	92 patients mild Alzheimer's disease (AD) 68 healthy controls Department of Neurology	73.8	Five screening tools were used to evaluate and compare the diagnostic properties for the diagnosis of mild AD using prospective and cross-sectional study. All tests yielded high diagnostic accuracy, with the ACE-III achieving the best diagnostic properties. The area under the curve was 0.897 for the ACE-III, 0.889 for the RUDAS, 0.874 for the MMSE, 0.866 for the Memory Impairment Screen (MIS), and 0.856 for the MoCA. The Mini-ACE score from the ACE-III showed the highest diagnostic capacity (area under the curve 0.939). Memory scores of the ACE-III and of the RUDAS showed a better diagnostic accuracy than those of the MMSE and of the MoCA. The ACE-III achieved the highest diagnostic accuracy. This better discrimination was more evident in the more educated group.
Nasreddine (2005) *Canada*	MoCA MMSE	Control 90 MCI 94 AD 93	72.8 ± 7.0 75.2 ± 6.3 76.7 ± 8.8	Using a cut-off score 26, the MMSE had a sensitivity of 18% to detect MCI, whereas the MoCA detected 90% of MCI subjects. In the mild AD group, the MMSE had a sensitivity of 78%, whereas the MoCA detected 100%. Specificity was excellent for both MMSE 100% and MoCA 87% respectively.

Pinto (2019) *Brazil*	MoCA MMSE	Systematic review 34 articles evaluated using QUADAS-2		More than 80% of the articles showed MoCA to be superior to MMSE in discriminating between individuals with mild cognitive impairment and no cognitive impairment. The area under the curve varied from 0.71 to 0.99 for MoCA, and 0.43 to 0.94 for MMSE, when evaluating the ability to discriminate MCI in the cognitively healthy elderly individuals, and 0.87 to 0.99 and 0.67 to 0.99, respectively, when evaluating the detection of AD.
Ryan (2019) *USA*	3MS MMSE	87 cognitively intact (CI) 206 of who diagnosed with Mild Cognitive Impairment (MCI)	(CI) 69.71 (7.61) (MCI) 74.88 (7.54)	The 3MS and MMSE were significant predictors of diagnostic outcome (CI or MCI) overall. However, the MMSE showed low sensitivity in detecting pre-dementia syndromes, poor content validity in assessing language, visuospatial, executive functions and ceiling effects. The 3MS is better able to discriminate MCI from normal cognition, with acceptable psychometric characteristics (sensitivity = 0.84, specificity = 0.71 for a cut-off of <95/100). In particular, the sensitivity of the 3MS was substantially higher than that of the MMSE (0.58) at optimal cut-off values 28/30, suggesting enhanced detection of early cognitive decline in older adults.The 3MS also demonstrated greater ROC area under the curve values (0.85, *SE* = 0.02) compared to the MMSE (0.74, *SE* = 0.03). The data results strongly favored the widespread substitution of the MMSE with the 3MS in older adults with concerns for cognitive decline.
So (2018) *Australia*	ACE-III ACE-R CDRS	251 out-patients clinic Sydney	69.6 (+/- 6.7)	Three studies completed: Study 1 ACE-III and ACE-R scores differed by ≥1 overall, the magnitude varying according to dementia type. Study 2 reflected the new lower bound cut-off ACE-III score of 84/100 to detect dementia was identified compared with 82/100 for the ACE-R. The upper bound cut-off score 88/100 was retained. Study 3 showered that ACE-III scores were significantly related to functional ability on the Clinical Dementia Rating Scale across all dementia types except Semantic dementia. The ACE-III therefore, is suitable alternative to the ACE_R for detection of dementia and relationship with functional ability.

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Mental Health

Study	Screening Measure/s	Population (e.g. diagnosis, inpatient, outpatient)	Mean age (SD; range)	Main findings
(Alvarez-Grandi et al., 2020) *New Zealand*	3MS	215 consumers undertaking course of ECT (inpatient and outpatient) Predominantly depression diagnoses but also BPAD and psychosis spectrum illnesses	44.23 (11.99) Range not recorded but all under 65.	Baseline 3MS not associated with autobiographical memory measures. Overall recommendation was that clinical battery was not particularly helpful and was not used to guide clinical decisions. Recommendation was to consider change to MoCA.
(Charernboon & Chompookard, 2019) *Thailand*	ACE-III	Diagnosis of schizophrenia, outpatient psychiatric clinic.	36.5 (12.0) range 20-60 years	People with schizophrenia scored significantly lower on the ACE-III compared to controls. With 15.6% scoring below <75/100 and 46.9% scoring below 82. As such a cut-off of 82 was recommended.
Dautzenberg et al., (2020) *The Netherlands*	MoCA	710 older adult mental health outpatients (diagnosis not specified), 96 healthy controls	72.5 (7.8) range 53-94	The MoCA is suitable for excluding cognitive impairment in an old age psychiatry setting. The MoCA is not suitable for diagnosing cognitive impairment in an old age psychiatry setting. In an old age psychiatry setting, the MoCA is valuable for confirming normal cognition (greater than or equal to 26, 95% sensitivity), excluding Mild Dementia (MD: greater than or equal to 21; negative predictive value [NPV] 98%) and excluding Mild Cognitive Impairment (MCI: greater than or equal to 26;NPV 94%); but not for diagnosing MD (less than 21; positive predictive value [PPV] 31%) or MCI (less than 26; PPV 33%).
Faustman et al., 1990 *USA*	MMSE	90 male psychiatric inpatients schizophrenia (43 %), schizoaffective disorder (12%), major depressive disorder (28%), manic disorder (3 %), minor depressive disorder (2%), unspecified functional psychosis (2%), obsessive-compulsive disorder (1 %), depressive syndrome superimposed on residual schizophrenia (I%), panic disorder (I%), and intermittent	40.5 years (SD NR) range = 23 to 66	The MMSE may seriously underestimate cognitive impairment in samples exclusively composed of psychiatric patients, making it inappropriate to rely solely on this instrument to distinguish psychiatric patients with and without cognitive deficit.

		depressive disorder (1 %), other psychiatric disorder		
Gil-Berrozpe et al., 2020 *Spain*	MoCA	140 patients with previous admission for first episode of psychosis 15 to 18 years earlier	49.09 (10.88), range NR	The MoCA is useful for screening long-term psychosis patients to detect cognitive impairment. Optimal cut-off for MoCA to detect mild cognitive impairment was <25 (senstivity = 0.92; specificity = 0.73).
Hermida et. al., 2020 USA	ECCA	131 persons diagnosed with MDD, 55 of whome were undergoing ECT.	59.0 (15.09) Range NR	There was no significant difference between MoCA and ECCA scores prior to treatment. However, scores on the ECCA were signicantly decreased across ECT treatment ($p<0.001$), while the MoCA did not change significantly across the course of ECT. ECCA was flagged as a potentially more senstive tool to specific cognitive impairments associated with ECT.
Mackin et al., (2010) *USA*	MMSE	52 community MH patients	69.4 (7.4), range NR	A cutoff score of 25 on the MMSE yielded a sensitivity of 43.3% and a specificity of 90.4% for detecting CI, whereas a cutoff score of 21 yielded sensitivity of 13.1% and 100% specificity. Poor sensitivity means that other tools should be used.
(Moirand et al., 2018) *France*	MoCA MMSE	48 inpatients undertaking ECT. Diagnoses of unipolar and bipolar MDD.	18-39 yrs (5); 40-64 yrs (31); >65 (12)	The MoCA detected a greater number of patients than MMSE with visuo-executive (21% vs 4%, p= 0.04), memory (46% vs 25%, p= 0.04), and language (29% vs 8%, p= 0.01) impairments induced by ECT. Significant modulation of MoCA domains (improved visuospatial and executive domains, decline to language) was noted with ECT treatment. Recommended that MMSE lack sensitivity to detect subtle clinical changes preceding or following ECT. It was suggested that MoCA memory items explore anterograde amnesia more extensively.
(Moore et al., 2004) *USA*	MMSE	161 outpatients diagnosed with schizophrenia	M= 56.0 (8.7) Range NR but older than 40.	23% of persons with schizophrenia scored below the MMSE cut-off (<24) compared to 0 healthy controls ($p<0.001$) MMSE scores related to severity of negative symptoms and psychosocial functioning (marital status, education, accommodation)
Musso et al., (2018) USA	MoCA	28 outpatient with severe mental illness, 18 controls	39.68 (11.63) range NR	The cut-off score of26 resulted in favorable sensitivity (0.89) but lower specificity (0.61) for patients with severe mental illness. An alternative cut-off score was recommended.
(Rasmussen, 2016) Review Article	MMSE MoCA	Review article cognitive screening in ECT	n/a	Review of recommendations of national medical boards and literature of recommended tools. Recommendations include testing of orientation and memory (both anterograde and retrograde), however, tends to be unclear or non-specified recommendations in most cases. However, most commonly recommended tools were the MMSE followed by the MoCA.

(Rosca et al., 2020) Systematic review	MoCA	Schizophrenia and psychosis spectrum disorders, over 18 years	n/a	Twelve studies: (i) three cross-sectional studies (ii) two case – control studies and (iv) three studies comparing MoCA to MMSE and (iv) four studies estimating the prevalence of cognitive impairment in the individuals with schizophrenia. MoCA reported as promising screening tool for people with schizophrenia. However, did propose the current cut-off of 26 may not be discriminatory in this population. Recommended a lower cut-off could provide a better balance between true positives and false positive results and could be used to identify individuals that should be investigated with a comprehensive neuropsychological battery. Alternatives utilized in studies reviewed were <25/30. Studies indicate the superiority of MoCA compared to MMSE in detecting cognitive impairment in psychosis spectrum disorders. Cognitive impairment on MoCA is associated with illness severity and negative symptoms.
Rotomskis et al. (2015) *Lithuania*	ACE-R	85 participants with early mild-moderate AD, 117 participants with late life onset depression (with severe episode), and 94 healthy controls	66.52 (±8.76) years) range NR	ACE-R has diagnostic accuracy in detecting people with AD and can be used in differential diagnostics of late-life onset depression (severe episode) and AD. The ACE-R had high sensitivity (100%) and specificity (81%) at detecting cognitive impairments related to AD. Participants with late-life onset depression were differentiated by mild impairment in the ACE-R total score (M: 76.82, SD: 7.36) with mild memory (13.79, SD = 6.29) and greater deficits in letter fluency (3.65, SD = 1.21) than in semantic fluency (4.68, SD = 1.23).
Walterfang et al., (2006) *Australia*	NUCOG	347 individuals, with 82 subjects in the control group and 265 in the patient group. The patient group consisted of patients with dementia (n = 65), non-dementing neurological disorders (n = 44) and psychiatric illness (n = 156). Psychiatry illness were psychotic disorders (n = 55), depression (n = 63) and other psychiatric disorders (n = 38).	47.31 (SD:15.73) range NR	At a cut-off score of 80/100, sensitivity of the NUCOG for detection of dementia was 0.84 and specificity 0.86.

Yhang et al., (2018) *Singapore*	MoCA	64 outpatients with schizophrenia	31.56 (SD: 7.54) range NR	The MoCA was sensitive to detect both mild (AUC= 0.82, p b .001) and severe (AUC= 0.81, p b .001) cognitive impairments. Optimal cut-off score of 25/30 for mild (sensitivity = 0.78; specificity 0.77) and 23/30 for severe impairment (sensitivity = 0.678; specificity 0.80).

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Older Persons Mental Health (≥ 65 years)

Study	Screening Measure/s	Population (e.g. diagnosis, inpatient, outpatient)	Mean age (SD; range)	Main findings
Dautzenberg (2019)	MoCA	710 patients in an old age psychiatry outpatient unit (60yrs+) with mild cognitive impairment (MCI) and mild dementia (MD)	72.5, (7.8), 53-94	MoCA is a suitable screening tool—in an old age psychiatry setting—for distinguishing between those in need of further diagnostic investigations and those who are not but not for diagnosing cognitive impairment. In an old age psychiatry setting, the MoCA is valuable for confirming normal cognition (greater than or equal to 26, 95% sensitivity), excluding MD (greater than or equal to 21; negative predictive value [NPV] 98%) and excluding MCI (greater than or equal to 26;NPV 94%); but not for diagnosing MD (less than 21; positive predictive value [PPV] 31%) or MCI (less than 26; PPV 33%).
Freire 2017	MOCA	352 older adults aged 55 years or more	59.76 (3.16)	In older adults with a diagnosis of depression or anxiety at baseline, no significant reduction in the MoCA score indicating deterioration in cognitive function was found 2 years later. Nevertheless, in individuals with a high level of psychological distress at baseline, there was a significant reduction in MoCA scores 2 years later, indicating deterioration in cognition. The findings of the present study suggest that a high level of psychological distress in addition to environmental factors may constitute important predictors for cognitive health.

Mackin (2010)	MMSE	52 older adults with cognitive impairment receiving services at a CMHC	n/a	A cut-off score of 25 on the MMSE yielded a sensitivity of 43.3% and a specificity of 90.4% for detecting cognitive impairment, whereas a cut-off score of 21 yielded sensitivity of 13.1% and 100% specificity. MMSE was found to be the more clinically useful cognitive screening tool (vs Stroop Color and Word Test [SCWT]) for use in CMHC. Yet, because of the poor sensitivity of the MMSE for detecting cognitive impairment in this patient population, alternative screening methods should be explored.
Moore (2004)	MMSE	161 middle-aged and older outpatients with schizophrenia	n/a	The MMSE was useful in detecting functionally relevant cognitive deficits among middle-aged and older schizophrenia patients who scored in the impaired range; however, those patients in the unimpaired range may still have subtle cognitive deficits that were not detected with the MMSE.

NR: Not reported

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Neurological / Rehabilitation

Study	Screening Measure/s	Population (e.g. diagnosis, inpatient, outpatient)	Mean age (SD; range)	Main findings
Abzhandadze (2018) *Sweden*	MoCA	550 patients 36-48 hours post stroke	69 (15) NR	Cognitive functions measured with the MoCA in the first 36-48 hours post stroke can partially reflect ADL performance. However it is likely that the MocA identified cognitive changes associated with post stroke fatigue, delirium and or emotional reactions. The authors further suggest that there is a need for an optimal cut off score be identified for this diagnostic group, and suggest this should be lower than 26/30.
Burton (2015) *UK*	MoCA MMSE ACE-R	Systematic review of 21 articles involving 2148 stroke survivors (acute stroke, rehabilitation and outpatient settings)	Average mean age 61 – 76	If the purpose of screening is to solely detect the presence of vascular dementia, the best option is the MMSE with a cut off score of 23-24. However the MMSE's sensitivity and specificity to detect mild cognitive impairment is variable and should not be used for this purpose. The MoCA can screen for all levels of impairment and is the most valid and clinically feasible tool to identify stroke survivors with a wide range of cognitive impairments. The ACE-R can detect any impairment and multi-domain impairments.
Cumming (2011) *Australia*	MoCA	220 participants 3 months post stroke (45% mild stroke, 32% moderate stroke, 23 % severe stroke NIHSS)	70.6 (12.8) NR	65% of patients with stroke were classified as cognitively impaired. The authors suggest that it may be possible that the recommended cut off of 26/30 is too high for this population. Performance was poor on items that had large attentional and executive demands including trail making, cube copy and letter fluency. Orientation was good reinforcing suggestions that the MMSE focus on orientation is mis-placed in this population.
Demeyere (2016) *UK*	OCS MoCA	200 patients within 3 weeks of stroke	70.5 (14.7) NR	OCS had higher sensitivity than the MoCA in detecting cognitive impairments (88% vs 78%). The OCS also detected significant numbers of patients with deficits in neglect, apraxia, reading, writing and number processing which is not formally assessed in the MocA. The OCS is inclusive for patients with neglect and aphasia – the orientation and executive function tests on the MoCA are more likely to be disrupted by milder language impairments than the equivalent assessments on the OCS.
Gaber (2011) *UK*	ACE-R	59 stroke patients admitted to a rehab ward within 3-7 days post stroke	72 (11.9) NR	The language component of the ACE-R sensitivity and specificity is comparable to other validated screening tools for aphasia following stroke. The authors recommend a cut-off value of 20/26 for the language component as it provides satisfactory sensitivity (90%) and specificity (95%)
Jaywant (2019) *USA*	MoCA Neuropsychologcal Battery	95 stroke rehabilitation inpatients	67.6 (15.2) NR	MoCA has moderately strong diagnostic accuracy in identifying individuals with cognitive impairment. A cut off for impairment on the MoCA of 25/30 provided the optimal balance of sensitivity (72-87%) and specificity (60-81%) for identifying stroke patients with mild or greater cognitive impairment particularly in those individuals with relatively high pre-morbid functioning.
Lannin (2004) *Australia*	CAM MMSE Cognistat	14 rehabilitation patients (43% stroke, 43% TBI, 14% Hypoxic brain injury. Patients with visual, language. auditory	56 (15) NR	The Cognistat had the highest sensitivity (93%), followed by the BNCE, BRISC, CAM, MMSE. The combination of the Cognistat and the CAM may increase specificity, which is

	BRISC BNCE	or motor disturbances that would confound completion of tests were excluded		likely to be useful for rehabilitation. The MMSE may not have adequate sensitivity to accurately screen for cognitive impairments with adults following acquired brain injury.
Lees (2017) *UK*	MoCA MMSE ACE III	51 adult inpatient rehabilitation patients minimum 2 weeks post stroke	74 (), 67-84	Partial completion of cognitive screens were common (ACE III 14/51, MMSE 22/51, MoCA 20/51). The majority of patients screened with ACE III (98%), MMSE (81%) and MoCA (98%) had results consistent with cognitive impairment, but when these results were compared to the findings of MDT assessment, the ACE III and MoCA had good sensitivity but not specificity because the accuracy of the test values varied depending on how the missing data was handled. When screening stroke inpatients with the ACE III or MoCA, almost all patients will screen positive, so if the purpose is to define a level of impairment that impacts on rehabilitation, scoring thresholds should be adjusted.
Manusco (2018) *Italy*	OCS MMSE	325 in-patients undergoing rehabilitation (within 180 days) for their first stroke	69.46 (12.53) 18-90	The OCS detected high incidences of stroke specific cognitive impairments, not detected by the MMSE e.g. neglect was present in 31% of patients unimpaired on the MMSE. The OCS had a comparable higher sensitivity (100%) as a screening tool for cognitive deficits after stroke compared to the MMSE.
Morris (2012) *UK*	ACE-R MMSE	61 acute stroke patients, median time since stroke 18 days	76 (no SD) NR	In comparison to the detailed neuropsychology battery of tests, neither the MMSE nor the ACE-R were able to detect the presence of overall cognitive impairment with adequate levels of both sensitivity and specificity. At higher cut off scores, (MMSE 27/30 and ACE -R 88/100), both tests had good levels of sensitivity (MMSE 80% and ACE-R 90%), but both had low specificity (20%). The ACE-R subscales (visuospatial, fluency, attention and orientation) predicted impairment in specific cognitive domains better than chance, however no cut-off score for any subscale gave both adequate levels of sensitivity and specificity.
Nokelby (2008) *Norway*	Cognistat CDT	49 stroke rehabilitation patients	62 (no SD) 25-91	Sensitivity for detecting cognitive deficits in any domain for the Cognistat was 82%, so it is a suitable screening instrument for cognitive deficits post stroke, however cannot replace a neuropsychological assessment. Determining which cognitive domains are particularly affected should be concluded very carefully. The Clock Drawing test added little information
Pendlebury (2012) *UK*	MoCA ACE-R MMSE	91 community participants more than one year post TIA or stroke presenting ith mild cognitive impairment	73.4 (11.6) NR	Overall, the MoCA and ACE-R had good sensitivity and specificity for Mild Cognitive Impairment in patients with stable cerebrovascular disease (MoCA <25 – 77% sensitivity and 83% specificity, ACE-R <94, 83% sensitivity and 73 % specificity). The MoCA and ACE-R had less sensitivity to single domain nonamnestic impairment, likely because there is a lack of timed tasks to measure reduced information processing speed. The authors suggest that the choice of cut-off will depend on whether the test is being used as a screen (high sensitivity) or a diagnostic tool (high specificity). The MMSE had lower sensitivity for single domain mild cognitive impairment. (A cut off score of <29 – 70% sensitivity) All 3 tests performed similarly in detecting multi-domain impairments.
Shea (2017) *USA*	Cognistat	Review of the properties of the Cognitstat only	NA	Cognistat is sensitive to cognitive impairment in stroke patients, particularly language (80%) and memory (69%). The Cognistat is more sensitive to identifying mild impairments compared to other measures such as the MMSE. However performance on the Cognitstat is also impacted by age and education.

Shi (2018) *China*	MoCA MMSE ACE-R	Systematic review of 12 articles published between 2010 – 2017, all conducted in hospitals, 2130 stroke patients in total	Not stated	Both the MMSE and MoCA are appropriate screening tools for post stroke cognitive impairment. The MoCA has higher sensitivity but lower specificity compared to the MMSE.. The optimal cut off for the MoCA differs in different stages of stroke, there is as yet no agreement on optimal cut off scores. Compared to the MMSE, the MoCA may be better at identifying mild cognitive impairment in stroke patients after a longer period of time since the onset (>1 year) The ACE-R can act as a supplement for the MoCA, however further studies are needed to research this further.
Stolwyk (2016) *Australia*	MoCA MMSE	Review of data from national clinical guidelines and psychometric research	NA	Traditional screening tools such as the MMSE are not able to detect the wide array of complex cognitive impairments that can result from a stroke. Additionally, specific impairments such as speed of processing and visual memory are not assessed within the MoCA placing a question mark over the utility of this tool also. Different studies also use different cut off scores for both the MMSE and MoCA which are not consistent with the recommended cut of score of 26. The author suggests that consensus is needed to use a consistent cut off score in this population.
Toglia (2011) USA	MoCA MMSE	72 inpatient rehabilitation stroke patients (FIM score of 4 on language comprehension only). Participants had high mean education levels	70 () NR	Mean scores on the MoCA and MMSE were significantly different suggesting that the MoCA may identify more cognitive impairments than the MMSE related partially to better assessment in visuo-executive and verbal fluency. The visuo-executive domain assessed by the MoCA showed a greater association with functional outcome than total scores in both the MoCA and MMSE – it contributed significantly to the prediction of discharge functional status and rate of change during rehabilitation.
Van Heugten (2014) *The Netherlands*	MoCA MMSE	Systematic review of 51 studies of stroke patients less than 4 weeks post stroke, 16 screening instruments were reviewed	Not stated	No instrument assesses all of the most commonly affected domains post stroke i.e., speed of processing, memory, executive functioning and visuospatial abilities. The MoCA is the best candidate at the time of this review, but the authors suggest that use of the MoCA should be accompanied or extended with measures of speed of information processing. The MMSE shows insufficient criterion and predictive validity in stroke patients and should not be used for screening purposes.

MoCA – Montreal Cognitive Assessment, OCS – Oxford Cognitive Screen, MMSE – Mini-Mental State Examination, ACE- Addenbrooke's Cognitive Examination, Cognistat – formerly Neuro-behavioural Cognitive Status Examination.

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Rehabilitation

Study	Screening Measure/s	Population (e.g. diagnosis, inpatient, outpatient)	Mean age (SD; range)	Main findings
Emerson (2019) *Australia*	MoCA RUDAS	102 patients in a geriatric rehabilitation ward (34 non-english speaking)	83 NR	The MoCA has higher sensitivity than the RUDAS with a score of less than 26, but a lower specificity – one potential explanation in the CALD population is the lower education level, with over half of the participants not attaining a secondary level of education. The authors also noted that as many patients with cognitive impairment revert back to their primary language, testing the patient in the correct language is very important. In this study a MoCA score of 18 (57% sensitivity/ 69% specificity) and a RUDAS score of 23 (52% sensitivity/70% specificity) had a similar sensitivity and specificity in predicting discharge destination to a nursing home.
Ghafar (2018) *Ireland*	MoCA MMSE CDT ACE-R	Systematic review of 15 studies, 1015 patients with vascular cognitive impairment	Mean age across studies 51.6-75.5 years	The MoCA was the most sensitive to identifying mild cognitive impairment but the specificity in identifying mild cognitive impairment was lower particularly at its established cut off of 26/30. The most accurate for identifying vascular dementia from controls was the ACE-R (but only one study). MMSE had good to excellent accuracy in differentiating vascular dementia form controls, but had lower accuracy in identifying mild vascular cognitive impairment. The CDT had moderate to high sensitivity but low specificity in separating vascular dementia from controls depending on the scoring approach used. The authors recommend the use of the MoCA rather than the MMSE or CDT as a stand-alone instrument to detect vascular cognitive impairment in routine clinical practice.
Heyman (2017) *Israel*	MoCA MMSE IQCODE	212 participants admitted to geriatric rehabilitation	75.45 (6.2) 65-96	The MMSE is the best predictor of discharge FIM scores (motor and cognitive) compared to the MoCA and IQCODE. The MoCA was not found to predict discharge FIM scores which is in contrast to previous studies which showed that the MoCA is a more efficient predictor of discharge FIM scores compared to the MMSE. The authors suggested that this may be due to the low level of education (average of 9 years) of the study population.
Sweet (2011) *Canada*	MoCA MMSE	47 geriatric rehabilitation program patients	83.5 (6.38) 70-102	The MoCA has greater sensitivity compared to the MMSE when screening for mild cognitive impairment. Additionally the attention subscale of the MoCA was uniquely predictive of functional gain. The authors concluded that in this population, the MoCA may be a more useful measure for detecting cognitive impairment and predicting rehabilitation outcomes.

MoCA – Montreal Cognitive Assessment, RUDAS – Rowland Universal Dementia Assessment Scale, MMSE – Mini-Mental State Examination, CDT – Clock Drawing Test ACE- Addenbrooke's Cognitive Examination- Revised, IQCODE – Informant Questionnaire on Cognitive Decline in the Elderly.

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Alcohol and Other Drugs

Study	Screening Measure/s	Population (e.g. diagnosis, inpatient, outpatient)	Mean age (SD; range)	Main findings
Alacon (2015) *French*	MoCA	166 adult patients hospitalised for alcohol withdrawal and rehabilitation	49.9 (9.2), NR	68% were impaired on the MoCA (<26). Age was negatively and education was positively associated with MoCA score. Cognitive deficits were in areas of attention, fluency, abstraction, delayed recall.
Álvarez-Alonso, (2017) *Spain*	TEDCA	160 adult patients with alcohol use disorder attending psychotherapy treatment (hospital based), 88 healthy controls	49 (8.54, NR)	The TEDCA focuses on the main cognitive domains impacted by alcohol – visuospatial, memory, executive function. It had good ability to distinguish patients from controls (.80), with sensitivity reaching 0.67 and specificity 0.77 (optimal cut-off point of 10.5).
Brown (2019)	ACE-III RBANS	28 adult patients with alcohol-related brain damage, 30 adult patients with alcohol dependence	ARBD: 56.9 (7.2) AUD: 46.1 (8.9)	The ACE=III was significantly able to differentiate between patient groups (at optimal cut-off of <87; sensitivity of 82% and specificity of 73%), as was the RBANS total score (<84 sensitivity of 89% and specificity 67%). Findings supported the use of both tests in clinical assessments of alcohol-users.
Bruijnen (2018) *Netherlands*	MoCA	82 adult patients with SUD seeking outpatient treatment in the Netherlands (primarily alcohol)	44.1 (13.8), NR	At 8 weeks follow-up, MoCA had a sensitivity of .67 and specificity of .73 (compared to impairment on a NPA), using a cut-off of <26. There was good correspondence between MoCA domain scores (e.g. memory, executive functioning) and NPA domains.
Copersino (2009) *USA*	MoCA	60 adult patients with SUD receiving treatment at a hospital-based D&A program in USA (primarily alcohol)	38.3 (13.2), NR	The MoCA had good accuracy (sensitivity of 83%, specificity of 73%) in classifying cognitive impairment (as assessed by a NPA) using a cut-off of <26. Also evidence of criterion validity (good agreement between MoCA and NPA domains). F
Copersino (2012) *USA*	MoCA	60 adult patients with SUD receiving hospital-based D&A program (primarily alcohol)	38.3 (13.2), NR	Evidence for predictive validity – patients who screened positive for cognitive impairment (MoCA <26) were less likely to attend treatment sessions, had a significant longer lifetime history of drug use.
Cunha (2010) *Brazil*	FAB	30 adult patients with cocaine-dependence receiving inpatient treatment	27.17 (7.64), NR	FAB was able to distinguish between controls and patients in 3/6 FAB subtests – mental flexibility, conceptualisaton, motor programming. There were correlations between FAB scores and traditional frontal tasks (i.e. criterion validity). The mean score on the FAB in the patient group was 15/18 (controls 16.7/18).
Ewart (2018) *France*	MoCA	56 adult patients with alcohol use disorder receiving inpatient rehabilitation	CI group: 49.6 (9.4)	MoCA had a good ability to distinguish between those with and without cognitive impairment based on NPA (a cut-score of <26 had: sensitivity 0.84, specificity 0.80). The authors suggest that the uncorrected score (i.e. not adding a point for lower levels of education) be used with the usual cut-off of <26.
Fals-Stewart (1997) *USA*	NCSE	51 patients admitted to a long-term residential substance abuse treatment program (primarily alcohol, cocaine, heroin)	CI group: 31.4 (5.2) Intact group: 27.9 (4.9)	The NCSE had low sensitivity (36%) and high specificity 86%) for detecting impairment (compared to a NPA). The authors suggest that the NCSE is not sensitive to mild forms of cognitive dysfunction.

Grohman (2004) *USA*	NAB-Screening Module	84 patients admitted to long-term inpatient substance abuse treatment program (primarily alcohol, cocaine, opiate)	32.0 (6.2)	The NAB-SM (at cut-off of <85) had good sensitivity (.81) and specificity (0.92) at classifying cognitive impairment (compared to a NPA).
Lintzeris (2016) *Australia*	ACE-R	99 older adult (50+) patients attending outpatient drug and alcohol treatment (primarily opioid and alcohol)	55 (4.5, 50-71)	The MMSE was less sensitive than the ACE-R in identifying CI – only 8% of participants met the threshold score on the MMSE (<24/30) while 41% had CI on the ACE-R (<82).
Marceau (2016) *Australia*	MoCA	128 adult patients of a residential AOD treatment community (primarily alcohol, heroin, amphetamine misuse)	35.0 (Median), NR, 19-56	A high proportion (43.8%) met criteria for cognitive impairment (<26). Higher MoCA score associated with higher psychological distress score (K-10). Patients hospitalised for a head injury had lower total MoCA scores than those who hadn't.
Pelletier (2016) *France*	MoCA	236 adult patients with alcohol use disorder admitted to a hospital based rehabilitation centre	50.4 (9.5), NR	On admission, 84% of patients scored lower than <26. At discharge (4-6 weeks later) MoCA score had significantly increased (average of 3 points; 47% off clients below cut-off). The authors suggest that this means that the MoCA seems to be a useful tool for evaluating changes in cognitive function in alcohol-dependent clients.
Pelletier (2018) *France*	MOCA BEARNI	90 adult patients with alcohol use disorder admitted to a hospital based rehabilitation centre	48.9 (9.6), NR	Compared to a NPA, the MoCA at a cut-off of <26, the MoCA had reasonable sensitivity (.79) with lower specificity (0.6%). The BEARNI Total (varying cut-offs) had high sensitivity (1.00) with low specificity (0.02); the BEARNI Cognition similarly had high sensitivity (0.98) with low specificity (0.13). The authors suggest that for use in routine practice the MoCA appeared to be the more appropriate tool.
Manning (2016) *Singapore*	MoCA MMSE	104 adult substance-dependent inpatients post detoxification in an AOD treatment service (Singapore); mostly drug-dependent (opioid, sedative).	44.3 (9.2), NR	CI was identified in 76% of patients using the MoCA and only 6% using the MMSE. The authors suggest that this may reflect its inclusion of items assessing executive functioning. Acceptability amongst patients was high.
Ridley (2018) *Australia*	MoCA MMSE ACE-R	30 adult patients with substance use disorders attending outpatient treatment centres (primarily alcohol, opioid, cannabis dependence)	52.3 (10.4) 32 to 76	The MoCA had good ability to detect CI (compared to a NPA); a cut-score <26 had lower sensitivity (<70) but higher specificity (83%), while <27 improved sensitivity (80%) for lower specificity (73%). The ACE-R also had a good ability to detect CI at a cut-score of <93 (sensitivity of 90, specificity of 73). The MMSE had fair discriminative ability but did not have an optimal cut-point for both sensitivity and specificity. Criterion validity was shown through the strong relationship of MoCA and ACE-R total scores to NPA overall score, however authors suggest caution should be taken in the use of subscales as representative of specific abilities.
Ritz (2015) *France*	BEARNI MMSE DRS	73 adult patients with alcohol-use disorder receiving withdrawal treatment in hospital. 254 healthy controls.	45.47 (8.85)	86% of patients had at least mild CI based on a NPA. The BEARNI's diagnostic accuracy in identifying CI ranged from acceptable to excellent; but had low specificity in identifying mild impairment. The MMSE (at cut-score of <24) had good specificity but poor sensitivity (10) and diagnostic accuracy was poor (20%). The DRS also had poor sensitivity (8%) and poor diagnostic accuracy (19%).
Rojo-Moto (2017) *Spain*	LOTCA	48 adult patients attending an addiction treatment clinic (primarily alcohol, cocaine)	39.8 (12.6), 18-67	There were correlations between LOTCA and NPA test scales. There were also significant correlations between the LOTCA and other screening tests (Allen Cognitive Level Screen-5, Brief Cognitive Status Examination). However, the LOTCA did not seem to measure executive functions or memory adequately (as assessed on NPA measures).

Rojo-Moto (2017) *Spain*	ACLS-5 MoCA	232 adult patients with substance use disorders recruited from an outpatient treatment centre (primarily alcohol, cocaine, cannabis, heroin)	38.26 (11.66), 18-71	23.3% of the group obtained an ACLS-5 score > 5.4 ('independent), while 34.6% were in normal limits on the MoCA (>25). The ACLS-5 score correlated significantly with those obtained on the MoCA (r = 0.32). The MoCA items more related to the ACLS-5 score were visuospatial, attentional, abstraction skills. The authors suggest that the ACLS—5 may be suitable as a measure of functional cognition in patients attending substance use treatment.
Oudman (2014) *Netherlands*	MoCA MMSE	30 adult inpatients diagnosed with Korsakoff Syndrome (all had extensive history of alcohol use)	59.5 (8.9), NR	Compared to the MMSE, the MoCA demonstrated consistently superior psychometric properties and discriminant validity. When applying traditional cut-offs, the MMSE (<24) misdiagnosed 47% of patients, while the MoCA (<26) diagnosed all patients correctly. Authors concluded that both tests have adequate psychometric properties as a screening instrument for detection of KS, but the MoCA is superior to the MMSE for this population.
Somhovd (2019) *Norway*	MoCA	142 adult inpatients of residential treatment centre; mainly opioid, stimulants and cannabinoids.	Retained: 33.1 (7.77. 20 – 54) Drop-out: 28.0 (5.97, 18-41)	Patients who scored below <26 had a statistically higher risk of dropping out compared to those with normal cognitive functioning. The authors suggest SUD patients should routinely be screened for CI, given association with dropout.
Wester (2013) *Netherlands*	MoCA	46 adult patients admitted to the Korsakoff Clinic for suspected alcohol-related cognitive impairment/ Korsakoff Syndrome	ARCI: 54.5 (8.1, NR); KS: 57.6 (8.7, NR)	MoCA score was able to distinguish patients with alcohol-related cognitive impairment from healthy controls (<25 had adequate sensitivity/specificity); and patients with Korsakoff Syndrome from healthy controls (<24); and also could differentiate between different levels of memory impairment (none versus mild versus severe).
Viswam (2018) *India*	MoCA FAB	56 men with alcohol dependence who attended an addiction clinic after completing detoxification (at least 7 days)	40.96 (9.6)	81% of patients were cognitively impaired on the MoCA (<26); 16% of patients had frontal executive dysfunction based on the FAB (<12). Both MoCA and FAB score were positively correlated with number of years of education.

ACLS-5: Allen Cognitive Level Screen-5; BEARNI: Brief Screening Tool for Alcohol-related Neuropsychological Impairments; DRS: Mattis Dementia Rating Scale FAB: Frontal Assessment Battery; LOTCA: Loewenstein Occupational Therapy Cognitive Assessment; MoCA: Montreal Cognitive Assessment; NCSE: Neurobehavioural Cognitive Status Examination, NR: Not reported; NPA: Neuropsychological Assessment; TEDCA: Test of Detection of Cognitive Impairment in Alcoholism

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