Determining acceptable and reliable cognitive testing methods in an Australian Aboriginal population

“Thesis submitted by Allison Olga Gray, Bachelor of Medical Science, Master of Public Health, held in partial fulfilment of the requirements for the Degree of Bachelor of Science with Honours in the School of Menzies School of Health Research, Faculty of Engineering, Health, Science and the Environment, Charles Darwin University. Submitted on December 2015.”
Statement of authorship

“I declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institute of tertiary education. Information derived from the published and unpublished work of others has been acknowledged in the text and a list of references given.”

X
Allison Olga Gray
Preface

“Aboriginal and Torres Strait Islander people (Indigenous Australians) are the Indigenous people of Australia. They live in all parts of the nation, from major cities to remote tropical coasts and the fringes of the central deserts. They are not 1 group, but comprise hundreds of groups that have their own distinct set of languages, histories and cultural traditions."

(Australian Institute of Health and Welfare 2014)

I wish to acknowledge the cultural, spiritual and linguistic diversity of the participants of this study. For quotation purposes Indigenous is used to describe both Aboriginal and Torres Strait Islander Australians.
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Allison Olga Gray
Abstract

Introduction: Cognitive tests are a measure of brain abilities including memory, judgement, evaluation, reasoning, problem solving, decision making, comprehension and language. These tests provide practitioners with information to guide treatment protocols, monitor treatment effectiveness and care planning. Cognitive tests are traditionally based on Western concepts and norms; often requiring familiarity with the English language and formal education. Current literature suggests that culturally specific and appropriate cognitive assessments for Aboriginal and Torres Strait Islander peoples is an underserved area that requires further investigation. Differences in language and culture mean that the psychometric properties of tests should be assessed prior to use in other populations, including Aboriginal Australians. The aim of this study was to examine the acceptability and reliability of four cognitive tests for future use in a randomised controlled trial investigating the optimum thiamine dose for treating and preventing Wernicke-Korsakoff Syndrome (WKS).

Methods: Medical staff at Alice Springs Hospital referred Aboriginal patients meeting the study’s inclusion and exclusion criteria. The cognitive tests included: Rowland Universal Dementia Assessment Screen (RUDAS) (n=19), PEBL Corsi Blocks (CORSI) (n=19), Story Memory Recall Test (SMRT) (n=17) and CogState Brief Battery (n=18). Each test was chosen as they measured specific cognitive domains, are supported for use in culturally and linguistically diverse populations and prior use at Alice Springs Hospital. Participants performed one to three tests with repeated assessment to determine test-retest reliability. Qualitative interviews and theme discussions were conducted to explore perceived acceptability of the tests.

Results: Test-retest reliabilities ranged from 0.61 (CogState one back accuracy) to 0.86 (RUDAS). Inter-rater reliability for the SMRT displayed high results (0.98-0.99). Several themes emerged across the four cognitive tests relating to general impressions, impacts on understanding and performance, appropriateness and assisting in understanding the task.
Discussion and Conclusion: All four tests demonstrated acceptable test-retest reliability. RUDAS, Story Recall and the CogState choice reaction time task showed the highest reliability. Overall the tests were viewed as a positive challenge, an opportunity to learn about the brain and reflect on the past. Certain caveats about test acceptability included the use of interpreters, impacts of convalescence and cultural relevance. Reliability and acceptability may be improved by providing instructions in Aboriginal language for those whose first language is not English.
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Introduction

Factors impacting brain function for Aboriginal and Torres Strait Islander people

Aboriginal and Torres Strait Islander people experience a multitude of health conditions at a higher rate than non-Indigenous Australians. Health disparities have been attributed to historical influences such as colonisation and dispossession, racism, social disadvantage and child removals (Australian Indigenous HealthInfoNet 2015; Newton et al. 2015).

Negative influences in early life, for example, childhood trauma, otitis media, and exposure to alcohol during pregnancy have the potential to impact on neurological, cognitive and emotional development. These influences have the potential to result in low educational performance, problem behaviour and risk of social marginalisation (Bartley et al. 2003). A lack of adequate or appropriate food can contribute to developmental delays early in life and potential malnutrition and nutritional deficiencies (Bartley et al. 2003).

Thiamine deficiency results from inadequate nutrition or thiamine malabsorption in excessive alcohol consumption and may lead to Wernicke-Korsakoff Syndrome (WKS). WKS is a neurological condition comprised of two components Wernicke’s encephalopathy (WE), an acute disorder characterised by mental confusion, ataxia, ophthalmoplegia and memory loss (Day et al. 2013; Isenberg-Grzeda, Kutner & Nicolson 2012) and a more chronic condition, Korsakoff’s psychosis (KP). KP occurs if the acute deficiency is left untreated (David et al. 2012; Scalzo, Bowden & Hillbom 2014). Executive functions and emotional behaviour are also impacted in KP including decision making, loss of initiative, loss of insight or interest, recognition of cues, irritability or pleasure, confabulation and reduction in capacity to learn from mistakes (Lezak et al. 2012).
Substance misuse has also been linked with social and economic disadvantage, perpetuating existing health inequalities (Bartley et al. 2003). Aboriginal people tend to experience a higher incidence of morbidity and mortality due to alcohol misuse compared to non-Indigenous Australians (Jayaraj et al. 2012). After age adjustment, surveys in 2008-2010 suggest that Indigenous females and males are hospitalised at four and five times the rate respectively of non-Indigenous Australians for a principal diagnosis related to alcohol (Australian Indigenous HealthInfoNet 2015). Aboriginal Australian death rates in New South Wales, Queensland, Western Australia, South Australia and Northern Territory related to alcohol are five to eight times higher in males and females respectively than non-Indigenous Australians, with 68% attributed to alcoholic liver disease (Australian Indigenous HealthInfoNet 2015). Mental health and behavioural disorders resulting from alcohol are seven times higher in Aboriginal than non-Aboriginal Australians (Australian Indigenous HealthInfoNet 2015).

Alcohol is a psychoactive substance that can cause harm via toxic effects to organs and tissues as well as intoxication with impairment of coordination, cognition, perception and behavioural dependence (World Health Organisation 2014). Alcohol misuse alters brain structure and function and affects cognitive processes of learning, memory, attention, reasoning and impulse control (Gould 2010). Atrophy of the cerebral cortex, reduced white matter volume, enlarged ventricles, atrophy of the hypothalamus and cerebellum are changes that can occur with excessive alcohol consumption (David et al. 2012). Alcohol has the potential to cause neuropsychological conditions, gastrointestinal diseases, cancer, intentional and unintentional injuries, cardiovascular disease, fetal complications, diabetes mellitus and infectious diseases (World Health Organisation 2014).

Alcohol consumption during pregnancy has the potential to cause Fetal Alcohol Spectrum Disorders (FASD), a collection of conditions that can be characterised by birth defects, developmental delay, language and speech deficits, poor judgement, short attention span, social and behavioural problems (Alcohol and Pregnancy Project 2009). FASD includes Fetal Alcohol Syndrome (FAS), Alcohol Related Birth Defects (ARBD) and Alcohol Related Neurodevelopmental Disorder (ARND). FAS has
a number of characteristic facial features, central nervous system and structural brain abnormalities (Alcohol and Pregnancy Project 2009). ARND displays similar central nervous system abnormalities as FAS and also characteristics of marked impairment in complex problem solving, planning, judgement and mathematical tasks, difficulties in personal manner, motor dysfunction and emotional lability (Alcohol and Pregnancy Project 2009).

Alcohol is also linked to an increased risk of injury due to motor vehicle accidents and violence (Ramakrishna & Wang 2010). In 2010, the alcohol-attributable fraction for road traffic accidents was 11.9% for males and 4.8% for females (World Health Organisation 2014). Traumatic brain injuries (TBI) alter cognitive function due to impact, acceleration or deceleration of the brain (Lezak et al. 2012). These types of injuries can occur from motor vehicle accidents, assault with blunt objects or penetrating head injuries. Alcohol and drug use is often a contributing factor for TBI. These types of injuries frequently occur due to risk-taking behaviour, a result of being under the influence at the time of injury (Lezak et al. 2012). The neuropsychological effects can vary by type of injury sustained. Closed head injuries (CHI) occur where there is impact and then mechanical deformation of the brain which creates changes in memory, diminished processing speed, emotional and executive function. Diffuse brain injury affecting the corpus callosum, frontal and temporal lobes is reflected with problems in mental speed, attention function and cognitive efficiency (Lezak et al. 2012).

Issues such as threat of job insecurity or financial burden from unemployment can cause stress impacting mental health including anxiety and depression (Bartley et al. 2003). Stress induces an adaptive hormonal action on the nervous system to initiate a biological response to maintain wellbeing or survival (Lupien et al. 2007). Chronic stress sustains the heightened state which can lead to infections, diabetes, high blood pressure, depression, anxiety and aggression (Bartley et al. 2003).

According to the 2012-13 Australian Aboriginal and Torres Strait Islander Health Survey (AATSIHS) 30% of people over 18 years old reported high or very high levels of psychological distress in the four weeks prior to interview (Australian Bureau of
After age standardisation, Aboriginal and Torres Strait Islander people were approximately three times likely to have experienced high/very high levels of psychological distress across all age groups (Australian Bureau of Statistics 2013). As previously mentioned, stress can impact on cognitive function and produce mental health issues. Cognitive impairments are present in schizophrenia and mood disorders like depression and bipolar disorder (Trivedi 2006). Processes affected in schizophrenia include verbal memory, visual memory, abstractions, attention, language and executive function (Green et al. 2000; Trivedi 2006). Cognitive processes affected in mood disorders include impairment of working memory, abstract reasoning, sustained attention, visuomotor skills and verbal memory (Trivedi 2006).

Risk factors including substance abuse, violence, head trauma, malnutrition, chronic illness and fetal alcohol syndrome (Dingwall & Cairney 2009) occur in high rates for Aboriginal populations. Therefore the risk for impaired brain function is likely to be high for this population leading to particular challenges for appropriate assessment and intervention.

**Assessment of brain function**

Cognition is a term for mental processes and abilities including: memory, judgement, evaluation, reasoning, problem solving, decision making, comprehension and language (Goldstein 2008). Cognitive tests are a form of psychological test which are administered and scored in a standardised manner used to monitor cognitive abilities. Psychological tests obtain information on cognitive, affective and interpersonal functioning using a systematic, standardised approach and comparison of results to a relevant group of peers (Meyer et al. 2001; Urbina 2014). Study of brain processes, assessment of cognition and behaviour forms neuropsychology, a sub-branch of psychology. Neuropsychological tests may employ a number of general cognitive tests to form a battery or be purposefully designed (Seidman 1998) (The Australian Psychological Society 2015). These measure specific brain functions including: visuospatial function, intelligence, memory, language and executive functions.
Cognitive tests can measure changes in brain function and detect abnormalities when comparing against healthy normative performance (Dingwall & Cairney 2009). Assessing brain function can provide diagnostic criteria through the course of disease and measure treatment effectiveness. It is important to identify conditions such as Alzheimer's disease at an early stage, to prevent or slow progression as regenerative medicine is yet to develop effective treatment to reverse the disease (Golde 2006).

Dementia, Wernicke-Korsakoff Syndrome and head injuries are conditions that would benefit from repeat testing to monitor changes over time. Cognitive tests provide practitioners information on progression of disease and have the potential to impact on treatment and referral to other health services. Psychological assessment is a comprehensive evaluation that considers tests scores in addition to information on social history, present life circumstances, medical history and current medical status and circumstances surrounding the examination (Lezak et al. 2012). Assessment is particularly important in Alzheimer's disease where there are benefits to early detection, allowing for patients to actively participate in decision making and planning future care (Leifer 2003).

**Origins of cognitive assessment**

It has been recognised that advancements in modern psychological testing began around the time of French physician Theodore Simon and Alfred Binet with the creation of an intelligence test in 1905, the Binet-Simon Scale (Kaplan & Saccuzzo 2009). These tests have been developed to compare an individual's results to a standardised normative sample (norms) and are often categorised by demographic variables such as age, gender and education. The Binet-Simon Scale was constructed with a standardised sample of 50 French children in 1905 and when further revisions occurred, the representative sample size also increased.

In 1916, Lewis Terman of Stanford University (United States of America) had modified Simon and Binet's scale to become the Stanford-Binet Intelligence Scale. The revision expanded the standardised sample to 1000 adolescents, modified
existing items and introduced new content (Kaplan & Saccuzzo 2009). Expansion of the standardised sample reflect an effort to become more representative of the population (Becker 2003). The Stanford-Binet Intelligence Scale was also revised in 1937, 1960, 1986 and 2003.

Howard Knox developed the cube imitation test in 1913 as a non-verbal test of intelligence for immigrants travelling to United States of America. This test was formulated due to the question of English proficiency and lack of cultural knowledge needed to complete the Binet-Simon scale (Richardson 2005). The test consists of four large cubes and a small black cube where the examiner moves the smaller cube in specific sequences and the participant is required to replicate the action. Knox's cube imitation test was seminal in inspiring variations used in performance-based scales (Richardson 2005).

In 1939, American psychologist David Wechsler published the Wechsler-Bellevue Intelligence Scale to measure adult intelligence. Wechsler advocated that there are additional interrelated factors involved in intelligent behaviour and that the current Stanford-Binet Intelligence Scale did not consider that performance may deteriorate with age (Kaplan & Saccuzzo 2009). Over time the Bellevue Intelligence Scale produced different iterations including Wechsler Adult Intelligence Scale (WAIS), Wechsler Intelligence Scale for Children (WISC) and the Wechsler Preschool and Primary Scale of Intelligence (WPPSI).

**Psychometric Properties**

Suitability of tests can be determined by evaluating their psychometric properties which examine whether tests measure what they are purported to measure (Brooks et al. 2009). Two frequently studied psychometric properties are reliability and validity. Reliability is a measure of consistency, where test-retest reliability determines if the test scores are similar over time. Inter-rater reliability compares the level of agreement between multiple raters measuring the same item. Validity in a test describes whether it accurately and meaningfully measures the theoretical constructs the test is supposed to measure (Creswell 2014). Face validity refers to
perception about whether a test measures what it purports to measure and if it is acceptable to the target audience. In general, if face validity of a test is low, a participant’s motivation to complete the test may be low and thus contribute to unreliable test scores (Gregory 2000). Content validity measures whether the test contains appropriate items regarding the domain of interest. Criterion validity compares the relationship to another independent measure that is accepted as a standard (Colman 2015). This study will focus on test-retest reliability, inter-rater reliability and face validity.

There are also other aspects considered in psychometrics including practice effects and the standard error of measurement. Practice effects occur where multiple administrations of a test increase a participant’s test score. Subjects may score higher on a test the second time because of practice, maturation, familiarity with test stimuli or other factors that take place between tests; however if the results strongly correlate, these aspects will not impact on reliability (Gregory 2000). The nature of psychological testing is not precise and test scores should be viewed as an estimate of function. The standard error of measurement (SEM) is an estimation of the amount of error in a score and inversely proportional to reliability. A low SEM indicates high reliability and high SEM indicates low reliability (Brooks et al. 2009).

With the majority of psychological testing developed in Western countries, test norms have generally been constructed from well educated, English speaking, Caucasian or European samples. There has been considerable discussion about reviewing this aspect to include racial diversity or culturally appropriate norms. Aspects that should be considered in determining the appropriateness of norms include: time point when the norms were created, if adequate number of subjects were included, if data was stratified in a way that captures impacts of demographics on test performance (Brickman, Cabo & Manly 2006).

Cognitive tests exist in several formats including: written (paper and pencil), verbal, and computer based. The format greatly varies according to the cognitive domain of interest. The evolution of computers has provided improved testing opportunities in
potential cost benefits, increased ability to precisely measure time-sensitive performance, vary difficulty of test through adaptive features and standardised administration or scoring (Bauer et al. 2012). There is also potential to reduce the effect of variables such as examiner's gender, age, appearance or ethnicity (Urbina 2014). Lezak et al. (2012) suggests that computer-based analysis may not be able to replace the qualitative aspect of assessment where examiner's record observations or personal interactions with the test taker.

**Cognitive assessment across cultures**

Modern cognitive tests are generally based on Western worldviews, utilise the English language, assume a certain level of education and utilise norms based on Western/European populations. Generally, these tests are poor in reflecting the scope of cultural diversity of minority groups including Aboriginal and Torres Strait Islander people.

Some tests have been modified to suit specific research purposes and certain demographic criteria. However further investigation is needed to explore the acceptability and reliability of these modifications to ensure appropriate use in the target population. For example, the Automated Neuropsychological Assessment Metrics (ANAM) is an American-based computerised battery designed with norms of high school athletes, college students and athletes, pre-deployment military personnel and healthy individuals ranging from young adult to late life (Snyder et al. 2011). Some of the tests in the battery have been translated into Spanish, German and Russian and have been used in research, screening in government employment, universities and neuropsychological testing (Snyder et al. 2011). Another computerised assessment, the Central Nervous System Vital Signs (CNSVS) used a normative sample of 1069 Caucasian, African American, Asian, Hispanic and other participants aged 7-90 years old from the United States of America (Gualtieri & Johnson 2006).
English is often a second language or third language for many Aboriginal and Torres Strait Islander peoples. Cognitive assessments require translation or interpretation of words that may not have an equivalent in Aboriginal languages and this will inherently disadvantage participants. Concepts of time, knowledge of events and personal values may differ between cultures. If assessed on culture-specific topics, one cannot determine if the test is detecting true cognitive impairment or highlighting an absence of knowledge or exposure to alternate cultural practices.

To address these issues, 'culture neutral' tests should be selected and the psychometric properties of the tests should be assessed within the population it is to be used. Previous research demonstrated that providing culturally relevant tasks enabled Aboriginal and Torres Strait Islander children from a remote background to perform a spatial memory task at a higher level than non-Indigenous children (Kearins 1981). New or modified assessments might therefore consider cultural and geographical characteristics.

**Cognitive assessment for Aboriginal and Torres Strait Islander people**

Aboriginal people have been influenced by a level of mistrust of Westernised processes due to historical impacts of colonisation and dispossession. Racism may contribute to gaps in medical care due to effects of low self-esteem, concept of shame, fear of discrimination and mistrust of the dominant culture (Purdie, Dudgeon & Walker 2010). Differences in worldview and particularly views on health may impact the cognitive testing process. The World Health Organisation defines health as "a complete state of physical, mental and social well-being, and not merely the absence of disease or infirmity" (World Health Organisation 1946). Australian Aboriginal health concepts are linked with the term social and emotional wellbeing to reflect views of the individual and the impact of their social structure.
“Aboriginal health means not just the physical well-being of the individual but refers to the social, emotional and cultural wellbeing of the whole community...” (National Aboriginal Community Controlled Health Organisation 2011). Newton et al. (2015) acknowledges the need for culturally specific tools to avoid misdiagnosis and cultural bias in social and emotional well-being assessment of Aboriginal and Torres Strait Islander people.

A literature review regarding appropriate cognitive and psychological testing for Aboriginal and Torres Strait Islander people suggests that there are limited resources that cater to the cultural diversity of Aboriginal and Torres Strait Islander population groups (Dingwall, Lindeman & Cairney 2014). Harris and Harris (1988) explore Aboriginal views to tests and questioning, children's independence values and Aboriginal learning styles. Differences in learning strategies between Aboriginal and non-Aboriginal Australians should be considered when planning assessment with Aboriginal people (Westerman & Wettinger 1997).

Aboriginal children are raised with a level of independence where they are able to state their own needs or wants in comparison to Western children who are taught to receive instruction from adults (Harris & Harris 1988). Assertion of independence is particularly evident when there are no kinship ties or obligations towards a stranger and this may have consequences for the testing process. The Aboriginal culture displays a preference for informal, non-verbal learning opposed to Western processes of learning which are largely verbal and structured in the context of school. Western views encourage individual personal responsibility and effort in regards to education and in Aboriginal culture school is viewed as a ritual-like practice where learning is conveyed by teachers rather than by individual effort (Harris & Harris 1988). Knowledge is an important concept in Aboriginal culture where responsibility resides with older people in ownership of information for the community. This may influence an individual's perception about education as students may not need to claim ownership or feel personally responsible for learning (Harris & Harris 1988). Another difference stated by Harris and Harris (1988) is the attitude in responding to questions where in Aboriginal culture, a response is not always expected. A number of direct questions may be seen as an
invasion of privacy. A western tendency is to answer the question, sometimes changing the subject. However for Aboriginal people ignoring the question may be considered an appropriate response. These cultural differences in values, beliefs, feelings and interpersonal behaviour have the potential to influence the test performance (Ardila 2005) and views on acceptability.

Variations in communication styles and whether question and answer designs are appropriate for minority groups are aspects of cross-cultural assessment considered by Westerman and Wettinger (1997). Intelligence tests such as the Wechsler Intelligence Scale for Children (WISC-III), Stanford Binet Intelligence Scales and Wechsler Adult Intelligence Scale (WAIS-R) were deemed of limited use for cognitive assessment with Aboriginal people as the tests do not have Aboriginal norms, contain unfamiliar concepts and assume knowledge of Western society and education (Westerman & Wettinger 1997). However, for Aboriginal people living in urban settings performance on the non-verbal, performance-based tests were comparable to existing Australian norms for the Raven's Progressive Matrices, WAIS-R and WISC-III (Westerman & Wettinger 1997) demonstrating better performance on tests less reliant on language. A connection to country, kinship relationships, religious or spiritual governance and effects of racism are also factors to be considered during psychological assessment with Aboriginal people.

**Test selection for Aboriginal and Torres Strait Islander people**

Research into appropriate cognitive tests for Aboriginal and Torres Strait Islander people is yet to be fully explored. Considerations of culture in Aboriginal mental health assessment and training suggested that successful approaches should integrate Indigenous culture and non-Indigenous concepts. Themes influencing mental health literacy that may provide insight for cognitive test development include: setting the context holistically, use of local language, use of pictures, storytelling, inclusion of modern and traditional perspectives, employing a two-way approach and engagement of local practitioners (Nagel et al. 2009). It would be appear advantageous to apply these principles to ensure development of culturally-adapted cognitive tests. Existing research on assessing cognition in Aboriginal and Torres Strait Islander people describes characteristics that should be considered
when designing and selecting cognitive tests for the population. The practitioner's theory on suspected mechanism of disease or injury, patient history, and clinical observations were shown to guide test selection choice. Other considerations included level of familiarity with Western culture, education, literacy and proclivity for non-verbal tests in clients with English as a second language (Dingwall, Pinkerton & Lindeman 2013).

Dingwall, Lindeman and Cairney (2014) discuss desirable characteristics for test development and selection. Criteria such as ease of administration, no time limit, not based upon a question and answer structure, portable, considered to be fun, engaging and visually appealing are important considerations for tests with Aboriginal clients (Dingwall, Lindeman & Cairney 2014). Test administrators should also consider the psychometric properties, the need for relevant and familiar stimulus material, a performance-based approach and minimal reliance on education-based skills (Dingwall, Lindeman & Cairney 2014).

**The Queensland Test**

The Queensland Test (Kearney 1966) also utilised concepts from the cube imitation test in regards to testing with Aboriginal and Torres Strait Islander people. Instructions for the Queensland test were administered through pantomime to minimise the effects of language and cultural differences, however it was noted that there was a relationship between test performance and exposure to Western culture (Kearney 1966). Westerman and Wettinger (1997) describe the norms as outdated and to have considerable variation. However, the non-verbal aspects of the Queensland Test are desirable characteristics that should be incorporated for cognitive testing with Aboriginal people.

**Kimberley Indigenous Cognitive Assessment**

The Kimberley Indigenous Cognitive Assessment (KICA) (LoGiudice et al. 2004) is one of the only cognitive assessments adapted specifically for Aboriginal and Torres Strait Islander populations. It was developed as a dementia screening tool, for people over 45 years old and validated for Aboriginal and Torres Strait Islander in the Kimberley region of Western Australia (Smith et al. 2007). Previous tools used in
culturally and linguistically diverse populations were not considered suitable for the Aboriginal people of the Kimberley. Previous tools used concepts such as numbers (unsure of equivalence in traditional languages), days of the week (differing perceptions of time), copying a diagram (variation in interpretation and meaning of shapes) and description of seasons (variations according to location) (LoGiudice et al. 2006). Initial validation of the KICA produced adequate inter-rater reliability results (κ≥0.6) for twelve out of sixteen questions. The study reported high internal consistency and high sensitivity and specificity for comparison of those with dementia and those no cognitive impairment (LoGiudice et al. 2006). Although one of the first specifically adapted dementia assessments for Aboriginal people, the test in its original form has limited applications for younger populations, brain disorders attributed to alcohol and limited executive function measurement. Further studies are also needed to assess reliability and validity with Aboriginal people outside of the geographic location of Western Australia.

**Rowland Universal Dementia Assessment Scale**

The Rowland Universal Dementia Assessment Scale was developed and validated for a culturally and linguistically diverse (CALD) population and has been translated into several languages. RUDAS also has the capacity to measure frontal lobe function, a characteristic not examined by many other dementia-specific assessment tools (Rowland et al. 2006) as dementia has widespread or diffuse impairment (Seidman 1998). This feature makes the RUDAS a useful measure for assessment of frontal lobe impairment attributable to chronic alcohol use (Oscar-Berman & Marinković 2007). Initial studies reported high inter-rater (0.99), test-retest reliability (0.98) (Storey et al. 2004a) and good correlations (measured by Spearman's rank-order correlation coefficient r_s) between existing, frequently used tests of a similar nature: the Folstein Mini-Mental State Examination (MMSE r_s=0.78) and the General Practitioner Assessment of Cognition (GPCOG r_s=0.78) (Basic et al. 2009). The MMSE is said to be influenced by age, education, ethnicity and language whereas the RUDAS and GPCOG were not (Basic et al. 2009).
Specific applications of tests

Some work has been conducted assessing psychometric properties of particular cognitive assessments and involving Aboriginal people with episodic or chronic alcohol use and petrol sniffing (Dingwall et al. 2010; Dingwall, Maruff & Cairney 2011). Dingwall et al. (2009) utilised a non-verbal, computerised test battery (CogState Ltd) to demonstrate adequate reliability and minimal practice effects for measurement of psychomotor function, visual attention and working memory in healthy Indigenous Australian adolescents.

Dingwall et al. (2010) also used the same computer battery to demonstrate that petrol abuse contributed to reduced performance on tasks pertaining to psychomotor, visual attention, memory, learning, spatial awareness and executive function. It was concluded that the particular assessment process utilising tasks of the CogState battery was useful in detecting impairment related to substance abuse in Aboriginal Australians. Overall, characteristics of age and computer familiarity accounted for some variation of results in the study. Computer familiarity accounted for some variation in the more complex, non-card based tasks of the battery and younger participants performed better on more complex speed measures (Dingwall et al. 2010). The same computerised test battery was useful in detecting impairments among chronic and episodic alcohol groups compared to controls. They demonstrated that alcohol use affected visual motor, learning, memory and executive functions for both chronic and episodic users (Dingwall, Maruff and Cairney 2011). The studies mentioned explored specific population groups and conditions and it is suggested that a wider scope is needed for future research.

Rationale for the current study

Aims

The limited assessment of reliability of appropriate tests for use with Aboriginal and Torres Strait Islander peoples has potential consequences that need to be addressed. If impairment is not detected, behaviour may be misinterpreted and lead to segregation from treatment programs. Conversely, false positive results may
lead to unnecessary testing, patient distress and increase demand for resources (Dingwall, Lindeman & Cairney 2014). Absence of reliable measures to detect change over time can impact on clinician or researcher ability to monitor disease progression or recovery. Further research is therefore desperately needed to assist researchers and clinicians to identify appropriate assessment tools for use with their Aboriginal and Torres Strait Islander participants and clients. The aim of this study was to identify acceptable and reliable cognitive tests for an Australian Aboriginal population.

As previously outlined, chronic alcohol consumption and WKS can affect memory, visuospatial organisation, psychomotor speed and executive functions so tests suitable for assessing these functions are required. The following principles also need to be considered for suitable test selection in an Aboriginal population: potential cultural bias, non-verbal attributes as a preferred style of test, previous use in research, knowledge and utilisation of the assessment by the staff on site.

The cognitive tests selected for this project are: CogState Brief Battery (CogState), Psychology Based Experimental Language Corsi Block-Tapping Task (Corsi), Rowland Universal Dementia Assessment Scale (RUDAS) and Story Memory Recall Test (SMRT). These tests were chosen as they measure a variety of cognitive domains including: psychomotor function, visual attention, working memory, visual learning, visuospatial working memory, memory, praxis, language, judgement, drawing, body orientation and auditory verbal learning. CogState and RUDAS also measure aspects of executive function (Basic et al. 2009; Dingwall et al. 2009) which are affected by excessive alcohol consumption.

The study will seek to address whether the assessments are appropriate and reliable for adults compared to previous studies which assessed reliability and validity of tests for children (Dingwall et al. 2009) and advanced age groups (LoGiudice et al. 2004).
Purpose Statement

This mixed methods study will seek to address the need for culturally acceptable cognitive assessments for adult Aboriginal participants of Alice Springs Hospital. A convergent parallel design will be used where the qualitative and quantitative data are collected at the same time, analysed separately and then integrated (Creswell 2014). Quantitative data will be collected to assess test-retest reliability. This will determine if the cognitive assessments are suitable for repeated assessment. Interview data will also be collected to explain findings from the statistical assessment and inform conclusions. These findings will also guide recommendations for selection of appropriate cognitive assessments for use in future substance misuse research.
Methods

Participants

A non-random convenience sample of participants was obtained through purposive sampling. There were 40 males and 44 female patients at Alice Springs Hospital, aged 19-72 years of age who participated in the study. Data collection took place during the period of March to December 2014. Participants originated from areas around Alice Springs, Tennant Creek and remote communities across Central Australia, Western Australia and South Australia. Collectively, the participants represented 30 different language groups.

The nursing staff at Alice Springs Hospital referred patients to the study who met inclusion and exclusion criteria. To be included a participant must have been admitted for a minimum of 48 hours, over 18 years old, Aboriginal or Torres Strait Islander and able to communicate in English without use of an interpreter as confirmed by the clinical staff. Participants were excluded from the study if they were pregnant, under 18 years of age, affected by the alcohol withdrawal process, had a documented pre-existing cognitive condition (circumstances that would affect decision making or cognitive processes) as judged by the clinical hospital staff, or unable to freely give informed consent (participants requiring assistance with decision making).

Several participants were approached to perform more than one cognitive test due to a small number of patients meeting the inclusion and exclusion criteria. The additional data collected allowed for comparisons of cognitive tests and to establish if some were perceived better than others. Fifteen participants agreed to perform more than one test. The greatest number of different tests performed by a participant was three.
Materials/Apparatus

The study explored the reliability of four cognitive tests in an Aboriginal population. The Rowland Universal Dementia Assessment Scale (RUDAS), Story Memory Recall Test (SMRT), Corsi Block-Tapping Task (Corsi) and CogState Brief Battery (CogState) were tested with participants at Alice Springs Hospital.

CogState Brief Battery (CogState)

CogState is a computer based program that was chosen because it is a standardised, non-verbal assessment that uses a card game structure. It was developed for use among Indigenous Australians and has been used for monitoring cognition in petrol sniffing, dementia, mild cognitive impairment and Alzheimer's disease (Dingwall & Cairney 2009; Hammers et al. 2011; Maruff et al. 2013). CogState assesses cognitive functions such as psychomotor speed function, visual attention, working memory and visual learning (Maruff et al. 2013). Playing cards have been described as universally recognisable and also that many Indigenous people enjoy or were familiar with cards (Cairney et al. 2007). The program provides simple instructions and prompts and allows for a practice before conducting the test. It is suggested

Figure 1: Test number by participant
that these features and the non-verbal nature aid in improving assessment for cross-cultural populations (Dingwall & Cairney 2009).

To initiate the testing process, the researcher entered participant details into the computer program (date of birth, gender and handedness). Each task was introduced with standardised instructions adapted from the computer program (See Appendix A). The script provided in the program was modified and simplified by removing words and replacing phrases with plain English. A training task called "fixed response mapping" allows the participant to practice pressing the yes and no keys. The 'D' key is designated as 'no' and the 'K' is designated as 'yes'. If a participant was left-handed the keys were reversed. The participant was allowed a short practice before each sub-task that did not form a part of the test. There were four sub-tasks selected to trial in this project: detection, identification, one card learning and one back task.

The detection task is introduced with "Has the card turned over?" The task requires the participant to press the ‘yes’ key as fast as they can when the card turns over. If any key is pressed before the card turned or the participant does not respond within a time of 5000 milliseconds (Makdissi et al. 2001) an error noise will sound. This task measures psychomotor function (processing speed), indicated by log10 transformed mean reaction time (milliseconds), where a lower score signifies better performance.

The Identification task is introduced with "Is the card red?" A card appears on the screen and the participant needs to press ‘yes’ for the colour red or ‘no’ for the colour black. An error noise will sound if an incorrect key is pressed or allotted time expires. The identification task assesses visual attention and is measured in the same manner as the detection task.

The One Card Learning task begins with "Have you seen this card before?" A card appears on the screen and the participant needs to decide whether it has been seen in the current task. The on-screen instructions state to press ‘no’ when the first card turns over. Participants need to use the ‘yes’ and ‘no’ keys. If an incorrect key is pressed or the time elapses an error noise will sound. This task measures visual
learning and memory via "arcsine transformation of the square root of the proportion of correct responses" (Cogstate Ltd. 2015), where a higher score indicates optimal performance.

The One Back task instructions state "Is this card the same as the previous card?" A card appears on screen and the participant needs to determine whether it is the same as the last. The initial on-screen instructions state to press ‘no’ when the first card turns over. Participants need to use the ‘yes’ key if it is the same card and ‘no’ key if it is a different card. An error noise will sound if an incorrect key is pressed or the allotted time expires. This task measures attention (working memory) and is calculated in the same manner as the previous task.

Once practice was completed, instructions were reiterated and then the test administered. If a participant did not want to proceed, the test was terminated at the end of the task in progress, reason recorded in the program's comments and the interview sheet. The results of the test were saved to the computer's hard drive and then uploaded to the CogState online database.

**Corsi Block-Tapping Task (Corsi)**

The Corsi was developed in 1972 and it is a test that continues to be used in contemporary practices. It has been used for analysis in several disease states such as Alzheimer’s disease, Korsakoff’s syndrome and schizophrenia (Kessels et al. 2000). Berch, Krikorian and Huha (1998, p. 319) state that the original "findings were so persuasive, that with no further validation, they firmly established the Corsi procedure as one of the preeminent measures of spatial memory." The test administrator points to a sequence on a set of blocks and the participant is required to replicate the exact order and continues until no longer correct. A computerised version of the Corsi was chosen for its non-verbal testing platform, history of use assessing a variety of conditions, ability to produce a standardised testing procedure and record results. The program uses the Psychology Experiment Building Language (PEBL) software to assess visuospatial working memory. The software program PEBL was designed in 2002 to allow researchers and clinicians to design, run and share behavioural tests (Mueller & Piper 2014).
To initiate testing the researcher started the PEBL Launcher where Corsi was selected from a subdirectory of test batteries. The participant study identification number was entered and ‘run selected script’ button pressed to launch the test. The program supplies on-screen instructions to the user, however additional prompts were developed using plain English and in consultation with the Aboriginal Project Officer at Menzies School of Health Research (Menzies) (see Appendix B). A screenshot of the testing platform was used to assist in describing the task to participants (see Appendix C). The participant is given three practice attempts before undergoing scored testing. In the computerised version a flashing sequence of coloured squares is used. The initial sequence begins with three squares and increases by one after each correct answer. Participants are allowed only one incorrect attempt on each number of blocks. If two incorrect attempts are made for the same number of blocks, the test ceases. Block span, memory span, total correct trials, total test time and total score results were saved onto the computer’s hard drive, written onto a results sheet (see Appendix D) and transferred to a Microsoft Excel spreadsheet. The total score is the only result used in the current analysis and denotes the sum of correct sequences across the test (Farrell Pagulayan et al. 2006).

**Rowland Universal Dementia Assessment Scale (RUDAS)**

RUDAS is a series of questions, physical actions and drawing tasks. It is used to assess signs of dementia and deficiencies in executive function by monitoring memory, praxis, language, judgment, drawing and body orientation (Storey et al. 2004a). The test was developed to assess frontal lobe functions not covered by other cognitive tests, counteract influences of education, cultural background and language factors that were present in other tools (Rowland et al. 2006). RUDAS was selected for the study as it has been validated as a suitable test for dementia screening in culturally and linguistically diverse (CALD) populations (Basic et al. 2009) and was used by the Addiction Medicine Team at ASH for repeated assessment of patients. The RUDAS has been translated into several languages including Italian and Chinese and there are specific guidelines to inform usage of professional interpreters or multilingual test administrators. A modified,
standardised script was administered to all participants. The original instructions were shortened by converting phrases to plain English (See Appendix E). Restructure of this script was performed by consulting Alice Springs Hospital Aboriginal Liaison Officers, the Addiction Medicine team and the local Aboriginal Interpreter Service (AIS).

The first question required the participant to memorise a four item shopping list, to be recalled at a later stage of the assessment. Items on the list can be repeated by the participant up to five times. The second item is called body orientation and the administrator asked the participant to identify different body parts. There are eight possible actions, with full marks given if five correct answers are obtained. Item three is called praxis and the administrator demonstrated an action with their hands and the participant was required to replicate the action from memory whilst the administrator observed the response performance. Item four is visuo-constructional cube drawing where the participant was shown a picture and asked to copy or reproduce the picture. Item five is a judgement question where the administrator described a scenario of the participant standing on the side of a busy street and they must describe what to do to get across safely. There are prompt questions to ask if the answers provided did not meet the criteria (see Appendix F). If additional information was provided after a prompt the answer needs to be circled for reduced scoring. The next item required recall of the shopping list. If the participant could not remember after 20-30 seconds, the administrator prompted with the first item 'tea' and the word was circled for reduced scoring. Item six called language generativity required the participant to state the names of many different animals within one minute where the maximum score was eight.

Data were recorded onto standardised results sheets included with the assessment (see Appendix F). Results were scored using the RUDAS Administration Scoring Guide (see Appendix G). The scores, test time and animal naming times were recorded and transferred to a Microsoft Excel spreadsheet.
**Story Memory Recall Test (SMRT)**

The SMRT required participants to memorise a fictional passage that includes an accident or negative event and immediately recall the details. The SMRT criteria for content and scoring were based on the logical memory subtest of the Wechsler Memory Scale (WMS) (Baek et al. 2011). Memory tests of this type test draw parallels to everyday memory requirements in conversation, radio, television and written material (Baek et al. 2011). The test was chosen as storytelling is a familiar practice in many Aboriginal and Torres Strait Islander cultures. Several Aboriginal people were consulted in the development of the stories to ensure the creation of culturally relevant and plausible content. An Aboriginal Project Officer, Aboriginal Liaison Officers and Indigenous Reference Group (consisting of representatives from local Aboriginal organisations) provided input for the two SMRT passages. There were several revisions of the stories and scoring guidelines to minimise repetition and to account for nuances in local vernacular.

The researcher introduced the test to the participant with a prepared script (see Appendix H). Instructions outlined that the test would begin with the researcher reciting a story. The participant’s aim would be to recount the story using the exact wording or to recall as much information as possible. The participant’s recall attempt was audio recorded (with consent) to ensure accurate transcription and scoring of results. A second story was initiated by the researcher and the process was repeated. The audio files were transcribed to a score sheet verbatim (see Appendix I). All results and recall times were transferred to a Microsoft Excel spreadsheet. Phrases were compared to the scoring guidelines (see Appendix J) and scored correct if there was an exact match or synonym of the original wording. The stories were scored by multiple raters for the calculation of inter-rater reliability.
Procedure

Ethics approval was granted by the Central Australian Human Research Ethics Committee (CAHREC) and the Human Research Ethics Committee of the Northern Territory Department of Health and the Menzies School of Health and Research, including the Aboriginal Ethics Sub-Committee. The project was also endorsed by the Alice Springs Hospital. Nursing team leaders were approached with the inclusion and exclusion criteria and asked to refer potential candidates. Individual patients were approached to discuss their possible involvement in the project. The purpose and goals of the research were explained using an information sheet (see appendix K), a plain English flip-chart and pictures (see Appendix L), or in conversation with an Aboriginal Liaison Officer present. The patient was also given an opportunity to ask questions about the research and procedures. If they appeared willing to participate, met the inclusion and exclusion criteria and gave informed consent, the researcher would proceed with the testing. A standardised consent form (see Appendix M) was discussed and signed by the participant, researcher and a witness. Test selection for the consenting participant was determined by the number of tests already completed by others. If an individual declined audio recording the SMRT could not be selected as a viable test because playback was required for later transcription.

After the test, a short qualitative interview was conducted with the participant. Questions for participants were developed in consultation with Investigators and an Aboriginal Project Officer. The researcher conducting the interview assessed the participant’s willingness to answer questions, determined the level of probing required and decided if additional questions would help obtain insight on acceptability of the cognitive tests. The set of questions for each cognitive test are listed in 'Appendix N.'

Participants were asked to perform the same cognitive test 24-120 hours later, where the procedure followed the same format as the initial encounter (except for the consent paperwork). The large time period accounted for participant needs and access to appropriate staff for referrals. Participants were not always able to
perform retests 24 hours later due to infirmity, medical procedures such as dialysis or scheduled operations. If participants were discharged or unwilling to complete the retest their quantitative results were excluded. The qualitative interview data remained in the study unless the participant asked for their details to be removed.

**File Audit**

Consent was obtained to view medical records enabling description participant health characteristics. Records were studied for presenting condition, secondary conditions, medications and pathology tests. Reasons for the hospital stay are described with a code based on the International Statistical Classification of Diseases and Related Health Problems, 10th Revision system (ICD-10). The ICD covers signs, symptoms, abnormal clinical and laboratory findings, injuries, poisoning, external morbidity and mortality causes and factors influencing health status and contact with health services. Chapters are constructed to enable description of disease or injury site, mode of transmission of disease and behaviour of neoplasms (Bartley et al. 2003).

Individual codes were transcribed from participant files to a Microsoft Excel spreadsheet, sorted into alphabetical groups and descriptions were obtained by comparing codes to the ICD-10 online version (Bartley et al. 2003). The total number of conditions per chapter were calculated and separated into primary and secondary diagnosis categories to obtain reasons for hospitalisation.
Data Analysis

Participant data forms were scanned and saved to a secure password protected network drive and audio files were transcribed verbatim. All quantitative data was entered into a Microsoft Excel results and demographics spreadsheet. Data cleaning methods were undertaken to ensure accurate calculations. Results were checked for mistakes in decimal places, physically impossible numbers, misspellings, transpositions and duplications on the spreadsheet. The data was compared to the original files and fellow researchers were also requested to review the results for potential data entry errors as a secondary measure. Data was imported into the statistical program IBM SPSS Statistics (SPSS) (IBM Corporation 2013) which was used to calculate descriptive statistics (mean, median and standard deviation), Chi-square tests, analyses of variance (ANOVA), Pearson’s product moment correlation coefficient (Pearson’s correlation coefficient), paired sample t-tests and intraclass correlation coefficients (ICC).

Chi square, a non-parametric inferential statistic (Heiman 2001) was utilised to assess differences between the groups performing each test for categorical variables - gender, English as first language and alcohol use history. The parametric statistic ANOVA was used to assess differences in age, education and languages spoken. Both statistics were used to establish whether there were any statistically significant differences in participant characteristics across each cognitive test.

Participants were assessed at two time points to assess the test-retest reliability and extent of learning effects. Test-retest reliability is the consistency with which participants obtain the same overall score when tested at different times (Heiman 2001). Test-retest reliability is represented by Pearson’s correlation coefficient, which describes the linear relationship between two variables (performance at baseline and performance at retest). The paired sample t-test statistic was employed to determine if baseline and re-test results displayed any practice effects by assessing whether there was a significant difference between performances at baseline compared to retest. Using the paired sample t-test will determine whether the selected cognitive tests are suitable to be used for repeated measurements to
reliably detect changes over time. Participants who were lost to follow up were excluded from this analysis in SPSS (as they were only tested at one time point).

The SMRT was scored by two raters and results were used to calculate the intra class correlation coefficient, a measure of inter-rater reliability agreement. This statistic determines how well scorers provide similar ratings and is calculated using continuous variable data for a fully crossed design (all participant tests in this study were each scored by two individual raters) (Hallgren 2012). Negative ICC values suggest consistent disagreement; values in the vicinity of zero suggest random agreement and values approaching one indicate perfect agreement (Hallgren 2012).

Qualitative Analysis

Participants were interviewed after the test ceased to gauge acceptability of the task. The audio files were transcribed and uploaded to qualitative analysis program NVivo 10 (QSR International Pty Ltd. 2012). This program enables the user to organise and structure data sources into logical groups and ideas. Individual researchers initially evaluated the qualitative data independently for recurring themes (i.e. more than one participant raised the issue). Researchers manually assessed transcripts for themes within individual tests and if there were any similarities across all of the tests. The research team came together to discuss their initial findings and a specific idea was assessed as a possible theme if there was majority consensus. For the purposes of this thesis, the data were reanalysed and coded for commonality with the following underlying areas of interest as guiding principles:

- General impressions and feelings about the tests
- What impacts on understanding and performance?
- Appropriateness of task format and content
- What would assist understanding and acceptability?

Participant responses were edited for grammatical clarity whilst retaining their meaning. Feedback from participants was initially grouped by interview question
per cognitive test. Data was then sorted under the guiding interview concepts and new subthemes were identified. Researchers participated in a secondary discussion about the NVivo output and revised themes were agreed upon by consensus.
Results

The purpose of quantitative analysis is to determine if the selected cognitive tests have appropriate test-retest reliability. This will potentially inform protocols that require repeat assessment for monitoring cognition in Aboriginal people. The qualitative analysis will provide researcher insight into acceptability of the study tests. Data obtained from the interviews will seek to provide a detailed description of the quantitative findings.

Participants

Figure 2: Study participant numbers
There were 84 individual participants in this study and a total of 176 tests were performed. Seventy three initial tests were followed up to obtain test and retest results (n=146 tests). Several participants performed two (n=12 participants) or three (n=3 participants) cognitive tests.

Lost to follow up participants

Thirty tests were lost to follow up due to participants being discharged or declining to continue (one participant was enrolled for CogState and RUDAS assessments but could not complete the follow up). There were also reasons such as recruitment to a randomised controlled trial (RUDAS 4%) and exclusion from analysis due to failed recording of SMRT results (3%). These issues are reflected in the “Other” category of 'Figure 3'. There were two declines for CogState and SMRT (9% and 7% respectively), three for Corsi (11%) and one for RUDAS (4%). Lost to follow up due to discharge included three for CogState (13%), five for Corsi (19%) and two for RUDAS (9%) and notably ten participants for SMRT (33%). The reasons for lost to follow up are outlined in 'Figure 3'.

Figure 3: Description of lost to follow up by cognitive test
Demographics (age, education, gender, alcohol history and languages spoken) of participants who performed test and retest assessments are described in 'Table 1.'

<table>
<thead>
<tr>
<th>Demographic</th>
<th>CogState (N=18)</th>
<th>Corsi (N=19)</th>
<th>RUDAS (N=19)</th>
<th>SMRT (N=17)</th>
<th>F Statistic</th>
<th>$\chi^2$ Statistic</th>
<th>df</th>
<th>Effect Size</th>
<th>Significance (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Mean years)</td>
<td>40.65</td>
<td>46.33</td>
<td>48.45</td>
<td>49.81</td>
<td>0.99</td>
<td>1</td>
<td>$\eta^2$=.06</td>
<td>.32</td>
<td></td>
</tr>
<tr>
<td>Education (Mean year)</td>
<td>10</td>
<td>8</td>
<td>9</td>
<td>9</td>
<td>2.44</td>
<td>1</td>
<td>$\eta^2$=.07</td>
<td>.12</td>
<td></td>
</tr>
<tr>
<td>Languages spoken (mean number)</td>
<td>2.39</td>
<td>2.42</td>
<td>2.26</td>
<td>2.65</td>
<td>0.64</td>
<td>1</td>
<td>$\eta^2$=.01</td>
<td>.43</td>
<td></td>
</tr>
<tr>
<td>English first language</td>
<td>7 (39%)</td>
<td>7 (37%)</td>
<td>6 (32%)</td>
<td>8 (47%)</td>
<td>0.93</td>
<td>3</td>
<td>V=.11</td>
<td>.82</td>
<td></td>
</tr>
<tr>
<td>Gender (Men)</td>
<td>6 (33%)</td>
<td>6 (32%)</td>
<td>8 (42%)</td>
<td>10 (59%)</td>
<td>3.37</td>
<td>3</td>
<td>V=.22</td>
<td>.34</td>
<td></td>
</tr>
<tr>
<td>History of alcohol use (Yes or No)</td>
<td>9 (50%)</td>
<td>4 (21%)</td>
<td>3 (16%)</td>
<td>4 (24%)</td>
<td>5.07</td>
<td>3</td>
<td>V=.27</td>
<td>.17</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Comparison of test and retest study participants by cognitive test
The average age of participants across each cognitive test approximately ranged from 40-49 years old and demonstrated a moderate effect size ($\eta=.06$). Females represented the majority of test-retest participants in CogState, Corsi and RUDAS. In the SMRT males were 59% of the participants. Across the cognitive tests gender demonstrated a moderate effect size ($V=.22$). Educational achievement averaged between year eight to ten across all tests and displayed a moderate effect size ($\eta=.07$). The study participants spoke an average of two languages (small effect size $\eta=.01$) and English as a first language varied across the groups (RUDAS 32% - SMRT 47%, medium effect size $V=.11$). History of alcohol use was 50% for CogState participants, 24% for the SMRT group, 21% for Corsi and 16% for the RUDAS group. The effect size for alcohol history was large across the cognitive assessments ($V=.27$). The p values for all individual characteristics are greater than .05 and suggests that there is no significant differences between the test-retest participants for each cognitive test.

**Disease classification codes**

Participant data obtained from the file audit containing ICD codes were organised and analysed according to their chapters, categories and sub-categories. This enabled the description of the study sample's characteristics. See 'Appendix O' for the chapter and category description table.

**Primary Diagnosis**

Diseases of the circulatory system (n=7, 13%), diseases of the skin and subcutaneous tissue (n=7, 13%) and injury, poisoning and certain other consequences of external causes (n=7, 13%) were the most prominent primary diagnoses for study participants. There were five participant records (n=9%) where data was unable to be recorded due to incomplete discharge summaries or use of codes incompatible with the 2014 ICD system.
Secondary Diagnosis

All participant files reviewed showed a number of co-morbid diagnoses. It was noted that the number ranged from two to sixteen conditions. Endocrine, nutritional and metabolic diseases (n=66, 27%), factors influencing health status and contact with health services (n=37, 15%), diseases of the circulatory system (n=26, 11%), diseases of the genitourinary system (n=26, 11%) were the most frequent secondary conditions.

Reliability of cognitive tests

Test-retest reliability of the four cognitive tests is represented in 'Table 3'. Total scores for the Corsi and RUDAS tests were used to calculate the Pearson's product moment correlation coefficient. There are four individual tasks in CogState and the following parameters were used to calculate the reliability: detection reaction time (DET RT), identification reaction time (IDN RT), one card learning accuracy (OCL ACC) and one back accuracy (OBK ACC). The SMRT has two stories and the total individual scores were used for the reliability calculations.
<table>
<thead>
<tr>
<th>Name of test</th>
<th>Pearson's Correlation Coefficient (r)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CogState DET RT</td>
<td>.65**</td>
<td>0.003</td>
</tr>
<tr>
<td>CogState IDN RT</td>
<td>.85**</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CogState OCL ACC</td>
<td>.69**</td>
<td>0.002</td>
</tr>
<tr>
<td>CogState OBK ACC</td>
<td>.61**</td>
<td>0.008</td>
</tr>
<tr>
<td>Corsi Total Score</td>
<td>.65**</td>
<td>0.003</td>
</tr>
<tr>
<td>RUDAS Total Score</td>
<td>.86**</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>* SMRT Story 1</td>
<td>.73**</td>
<td>0.001</td>
</tr>
<tr>
<td>* SMRT Story 2</td>
<td>.71**</td>
<td>0.002</td>
</tr>
</tbody>
</table>

* Participant SMRT results were independently evaluated by two scorers. An average of these scores was used in calculation of the Pearson’s correlation coefficient.

** Correlation is significant at the 0.01 level (2-tailed).

Pearson's r results ranged from: 0.61 (CogState One Back accuracy) to 0.86 (RUDAS Total Score). Corsi total score, CogState OBK ACC, DET RT and OCL ACC had moderate positive strength correlation coefficients. SMRT Story 1, Story 2, CogState IDN RT and RUDAS Total Score had strong positive correlation coefficients. All of the test p-values are statistically significant at the level of α=0.05.
Table 3: Paired sample t-test by cognitive test

<table>
<thead>
<tr>
<th>Test</th>
<th>Sub Task</th>
<th>Test Mean</th>
<th>SD</th>
<th>Retest Mean</th>
<th>SD</th>
<th>Effect size Cohen's d</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>CogState</td>
<td>DET RT</td>
<td>2.69</td>
<td>0.21</td>
<td>2.63</td>
<td>0.17</td>
<td>0.30 t(17)=1.52, p=.15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IDN RT</td>
<td>2.80</td>
<td>0.12</td>
<td>2.78</td>
<td>0.14</td>
<td>0.10 t(17)=0.71, p=.49</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OCL ACC</td>
<td>0.90</td>
<td>0.11</td>
<td>0.94</td>
<td>0.17</td>
<td>-0.24 t(17)=-1.17, p=.26</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OBK ACC</td>
<td>1.10</td>
<td>0.30</td>
<td>1.20</td>
<td>0.26</td>
<td>-0.36 t(17)=-1.69, p=.11</td>
<td></td>
</tr>
<tr>
<td>Corsi</td>
<td>Total Score</td>
<td>37.44</td>
<td>14.56</td>
<td>41.33</td>
<td>14.99</td>
<td>-0.26 t(17)=-1.34, p=.20</td>
<td></td>
</tr>
<tr>
<td>RUDAS</td>
<td>Total Score</td>
<td>24.95</td>
<td>3.96</td>
<td>25.68</td>
<td>4.22</td>
<td>-0.18 t(18)=-1.49, p=.15</td>
<td></td>
</tr>
<tr>
<td>SMRT</td>
<td>Story 1</td>
<td>8.62</td>
<td>4.48</td>
<td>11.00</td>
<td>4.54</td>
<td>-0.53 t(16)=-2.98, p=.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Story 2</td>
<td>9.44</td>
<td>3.52</td>
<td>9.82</td>
<td>4.30</td>
<td>-0.10 t(16)=-0.51, p=.62</td>
<td></td>
</tr>
</tbody>
</table>

The significance level for this test was 0.05. Paired sample t-test significance for CogState subtasks, Corsi, RUDAS and SMRT Story 2 ranged from p=.11-.62. The SMRT Story 1 p=.01 suggested significance for potential learning effects and Cohen's effect size d=-0.53, suggesting a moderate effect. All other cognitive test Cohen's d results ranged from -0.10 to 0.30 signifying small effects as per common statistical guidelines (Cohen 1988).

The inter-rater reliability (IRR) was used to determine if the individual scoring practices of SMRT assessors were consistent with others. IRR for the SMRT is represented by intra class correlation and displayed in 'Table 4.'
Table 4: SMRT Intraclass correlation coefficient

<table>
<thead>
<tr>
<th>Test</th>
<th>Intra class correlation coefficient (agreement)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Story 1</td>
<td>0.98</td>
</tr>
<tr>
<td>Story 2</td>
<td>0.99</td>
</tr>
<tr>
<td>Retest Story 1</td>
<td>0.99</td>
</tr>
<tr>
<td>Retest Story 2</td>
<td>0.99</td>
</tr>
</tbody>
</table>

Possible ICC results fall between 0 and 1. Each of the stories for test and retest events displayed high interrater reliability with results from 0.98 to 0.99.
Qualitative Results

General impressions and feelings

A challenge

Researchers noted that three out of the four cognitive tests (CogState, Corsi and RUDAS) were generally received better than the SMRT. It was observed that a few participants were willing to engage during the consent process however once the voice recorder was presented, demeanours changed and people became shy and reserved. A willing study participant was interested in performing the SMRT but was adamant they didn't want their voice recorded therefore the participant's recount of the stories were instantly transcribed. Despite some initial concerns, most participants described the tests as challenging but in a positive manner. Some tasks were perceived to be easy at first; then increased in difficulty and therefore a source of confusion but still generally enjoyable.

"Started out easy and then got hard. Was a good challenge." P12

Corsi

"Liked that it gave me a bit of a muddle in my brains." P9 Corsi

"Not bad, like playing a game but it got too hard. This is a good way to test memory. The touch screen was good." P017 Corsi

"It’s not complicated but you’ve got to take notice and you’ve got to absorb it. It’s quite hilarious, unusual.” P45 SMRT

There were also some negative aspects to the challenging nature of the tests. Some participants believed the tests were confusing, too hard, did not like the length or speed of the tests, or were concerned with increased difficulty and their ability to remember the exact words (for the SMRT).

"I got worried because I might make it wrong.” P21 Corsi
“Hard to remember the exact words. I got mixed up and blank.”

P40 SMRT

“Make the story shorter to make it easier for others.” P28 SMRT

“On the second and third task I was not sure which one to pick and it felt like a long time.” P26 Cogstate

Performance Anxiety

The tests therefore summoned a variety of feelings from participants. A number discussed feelings of frustration, anxiousness and disappointment. Participant P4 (CogState) acknowledged that “It is a test and we all get frustrated and nervous... Being nervous is a natural part of life and this anxiety is channelled into test performance.” Another participant discussed the decision-making time pressures of the test and the juxtaposition to ‘normal life.’

“You have to make decisions on the split second and that’s what’s different about it... where normal life skills you have a choice... You have time to weigh everything up.” P22 CogState

Memories and an opportunity to learn

Memory was a topic frequently mentioned during the interviews. It was perceived that tests would help improve memory and the process of testing raised memories for several participants. Memories included: remembering workplace policies and procedures, drinking, working outside and playing games with their kids. Participants also related some of the test tasks to daily activities.

“[The visuospatial orientation task is] like a small child learning their left and right.” P28 RUDAS

“I might buy these things [in the shopping list task]. I cook all those at home.” P57 RUDAS

"Test made me frustrated. It made me think back to when I used to drink and when I was working outside...The test improves my
mind and brings back memories from years ago. This could help heal people’s minds and help bring memories back.” P29 CogState

Participants therefore viewed the tests as an opportunity to learn about their minds, a means to keep busy, to learn about computers and increase awareness of brain function. Some thought it was good to test their brains due to situations such as substance use, being a victim of violence and forgetfulness. They believed that the tests made them pay attention, focus and concentrate.

“An activity like this is good; it keeps you tuned into what your brain does.” P4 SMRT

“Other people could learn about their minds from this test. Should get a lot of people to do this test.” P29 CogState

Impacts on understanding the task and performance

When asked how other Aboriginal people would perform on these tests, most respondents felt that they would perform reasonably well. A few participants were concerned that older Aboriginal people or those with English as a second language would struggle with the tests due to lack of familiarity with the testing process and certain language concepts.

"Older people would struggle using the computer and understanding the test in English." P26 CogState

Language

Language was overwhelmingly cited by participants as a factor that may influence understanding of the test. Participants' viewed English proficiency as a potential way to increase performance. A number of participants were concerned with word usage and pronunciation affecting their understanding.

"If people know English they will do well in the test." P32 CogState

"Might be too hard for non-English speakers." P96 CogState
"Would be easier to understand in my own language." P5 RUDAS

"I only know plain English. A bit hard to pronounce." P67 SMRT

"Sometimes I can’t [pronounce] the way you talk." P90 SMRT

"Get someone from community to talk and liaison [officers] and explain it. Cause he won’t understand yous two...He might think monster jump out of the screen or something." P9 Corsi

Convalescence
Participants expressed concern about their convalescence and its potential impacts on their performance. The ability to think and concentrate was monopolised by their illness or social situations. Participants discussed substance abuse, stroke episodes and revealed head injuries due to domestic violence as concerns for their memory.

"...I am thinking about other things... I followed your words, but I picked up others. I like it but not really too good at it because I am sick at the moment." P8 SMRT

"Testing the memory, refreshing yourself, but the hospital is not a good place to do it because patients are sick." P39 SMRT

"It does make you stop and think... I think somebody with alcoholism it would be a lot harder." P41 SMRT

One participant was concerned that his "mind goes blank" due to his use of marijuana. "I'm not in my right mind. If I was in my right mind I would be able to remember the whole story." P46 SMRT

"If you would have asked an older person, or someone affected by grog or sniffing petrol then their brain wouldn’t have been ticking properly (to remember)." P43 SMRT
There were physical obstructions such as limbs in casts or traction, medical equipment and intravenous fluid lines that may have influenced participant performance on physical aspects. For example, IV cannulation and being connected to dialysis impacted on the ability to form upright fist on the RUDAS praxis task for a couple of participants and a plastered hand impacted on using yes and no keys in Cogstate (which required both hands) for another participant. A few participants also expressed concern for others with vision or hearing problems. These issues had the potential to impact on performance.

“Other Aboriginals would find this test hard, especially those with hearing impairment”. P8 RUDAS

“The pictures bigger. Some people probably can’t see properly much.” P76 CogState

**Education**

Some participants believed that a lack of education made the activity challenging and those with more education would find the activity easier. The issue of education was particularly apparent for the Corsi test as it required the use of a computer and acceptance of a seemingly abstract concept. Some participants appeared confused and needed additional explanation of the test rules. Clarification included waiting till the sequence was finished before commencing their attempt, instruction on finger pressure for the touch screen and reminders to press done to acknowledge the sequence was finished. Participant P9 Corsi mentioned that others might not know the English word blue and suggested that we point to the block on our screen shot.

“Just those numbers, make sure he knows his numbers... If he [doesn’t] know his numbers he’ll miscount, that’s another thing.”

P9 Corsi

"Hard to explain the test to someone else. Lack of schooling made this activity hard." P11 Corsi
Interruptions and distractions

Researcher observations were examined for potential sources of distraction for participants and these were grouped by noise levels and interruptions. It was found that more of these issues were noted for the computerised tests.

The non-verbal tests had six instances of noise and interruptions whereas the computerised tests had 24 observations noting these. RUDAS had one mention of noise and one interruption. The SMRT had two noises and two interruptions. Corsi had one interruption and six episodes of noises and CogState had five interruptions and twelve occurrences of noise.

The hospital environment was often loud with high potential for distractions including: other patients, chart observations, visitors, machine alarms, television volume, phone calls and medication administration.

Appropriateness of the task format and content

Computers

A number of participants did seem comfortable using the computerised tests despite varying levels of education and exposure to technology. Many participants had limited involvement with computers but some did not appear to be bothered as they likened the experience to games on their mobile phones. One participant suggested that “not a lot of Aboriginals have access to computers. Make a smart phone app instead of a computer because people are more familiar with phones.” Some participants that performed multiple tests stated they preferred the computer-based tests as opposed to the verbal tests. Participant P22 (CogState) mentioned that “some Aboriginal people may not want to do testing person-to-person because they don’t trust their information will be used appropriately...with the computer you know it’s not going to be flung back in your face.”
Familiarity

*However,* it was noted that perceptions of task appropriateness may change due to familiarity with content and by location and diversity of different population groups. SMRT stories appeared most relevant to people who reside in or have knowledge of remote areas. CogState appeared most relevant to people who actively played card games. Overall, the computer-based tests seemed more relevant to those who had used computers.

"...That is the kind of stuff they like (people out bush)." P38 SMRT

"I didn't learn cards... The ones that play cards would like this game." P79 CogState

"...Not sure if Aboriginal people from other places will relate to the stories." P39 SMRT

"Some people would find this confusing and hard to understand the instructions due to language barrier, low level of education and also elderly people who are not used to computers." P17 Corsi

"Those who have not had much contact with computers may find it hard to control impulses to push any button. It is important that we explain to people that they don’t have to get the right answer all the time." P22 CogState

"They would probably be wondering why I am sitting here playing a little computer for. Why is that? They could be laughing at you." P95 CogState

"Some will pick it up easily and some will not because they might not have computer training." P16 Corsi
Cultural relevance

Cultural relevance and relatability were resounding influences concerning appropriateness of the task. The stories created with aspects of remote community life were generally considered suitable and relatable. Test content invoked memories and comparisons to everyday life. The playing card stimulus in CogState is a well-known symbol for a number of Aboriginal people and most participants were comfortable with the format. Those that did not play cards were indifferent to the test but related the stimulus to other people in their community who enjoyed the past time. The process of reciting stories was noted as common practice in Aboriginal culture. Whilst participants thought that the content and format were relevant, it was observed that there was a level of discomfort performing under structured conditions, especially with the voice recorder.

"Story game was interesting as the story was realistic...Good stories and grateful to read them...The story is a good way of checking memory because it is real life." P42 SMRT

"What the stories say, our people, that's what we do. We go out hunting and all those things, you know. It's good." P67 SMRT

Conversely, a few participants questioned the authenticity of the content. Another participant was concerned about being requested to repeat words of the SMRT verbatim. The exact structure and rules of the test was not a familiar concept.

"Most Aboriginals paraphrase and leave out details that aren't important; even if they actually know those minor details...Older Aboriginal people can't remember names and modern things but they are unbelievable at remembering landmarks and traditional things." P33 SMRT

"The team would fix the tyre blackfella style by tying their shirts around the wheel because they would not have missed the game...

You should come up with a story that is more relevant to Aboriginal people." P41 SMRT
Participants were frustrated with the repetitive nature of the testing. There were particular concerns with the shopping list task of the RUDAS and option for participant to repeat the list up to five times. CogState also appeared to be a source of frustration due to length and frequency of certain tasks.

"I don't like talking the same thing over and over. Some people would get angry if asked to repeat over and over. People would remember the shopping list, even if they didn't repeat it a few times." P25 RUDAS

"The tasks were not easier and still repetitive this time round..." P4 CogState

In discussion about specific tasks it was apparent that context and worldview influences how a question is interpreted and answered. Participants made comparisons to personal experience and suggestions to improve the delivery.

"Most people do not buy eggs. This is hard to remember. Everyone buys flour, tea, sugar, milk and bread." P9 RUDAS

"Some people will get it, others won't. Not sure if there is a word for left hand side, right hand side in language. I never tried it." P25 RUDAS

A number of participants asked for the stories to be re-read as cultural practices are often guided by repetition in storytelling.

"...In corroboree people follow from one point to a second point but they may repeat that in a song up to three times. That is why a lot of older people will memorise it that way." P43 SMRT

A few participants mentioned that they would prefer to do the testing in a different environment. "Would be better outside or out bush" P81 RUDAS. There were three instances where testing was not performed bedside. Two participants insisted on
performing the retest assessment in the hallway as they were more comfortable away from their room (P77 CogState P96 Corsi and CogState). One participant was discharged but wanted to complete the process so they agreed to meet the following day in the car park of the hospital (P4 SMRT).

What would assist understanding and acceptability?

Introduction process

Aspects of the introduction process were mentioned as potential influences on understanding the test. Participants described the importance of introducing and explaining the tests appropriately. It was observed that participants wanted to be prepared or relaxed, and gain a true understanding of the task to be performed. Suggestions for improvement in explaining the tasks to others therefore included providing enough warning to mentally prepare, use of pictures and physical cues and ensuring a comprehensive explanation delivered in plain English, providing opportunities for practice or ‘warm ups’, repetition and interpreters.

“It’s all about the delivery.” P4 RUDAS

“A really big story like that, you need to relax first. Because if you’ve got a lot of things in your mind, going round and round you know, you can’t really think about what happened…” P88 SMRT

"...You told me to warm it up...I’ve seen this before. But the one thing was; I pressed the wrong button. So I woke up myself and I said I've seen this before." P95 CogState

"If I had to explain it; show picture first, test-run, and explain it step by step." P12 Corsi

“You could use actual cards. Aboriginal people have seen cards throughout their lives. They know what they are about.” P22 CogState
Interpretation

Language was mentioned as an obvious factor to be considered to ensure appropriate communication and understanding. The general consensus of participants was that instructions in their first language, use of an interpreter and Aboriginal Liaison Officers would assist understanding and improve performance. Conversely, a few participants noted that the adapted plain English instructions were sufficient.

“If there are people with little bit of English, then you need an interpreter.” P16 Corsi

“Some sort of interpreter and all that. So that they would know. So they can understand properly. Some are misunderstanding.” P95 CogState

“We use ALOs to help. The introduction to this activity is important and that people should understand why they are doing the test.”

P17 Corsi

Format and content changes

Another frequently mentioned issue was format of the test delivery and there were a number of proposals for altering the format or content of tasks. Participants made suggestions such as use of physical objects (playing cards) to make the task more concrete or relevant.

“Actually sit down and play the game with them using cards.” P32 CogState

Other suggestions included to incorporate content such as football and other sports, group testing so the person didn’t feel singled out and have other options to record answers (apart from audio). Several participants confirmed that the pictorial resources provided (flipchart and screenshot of testing platforms) were helpful in gaining understanding of the task.
“The flip chart is good. Pictures are better (than words)....” P12 Corsi

“You could put pictures behind the blocks (shapes and animals) so that people can remember what’s behind it.” P19 Corsi

"Some people would be shy if asked to do the test on their own and would perform better if get a few of them together." P25 RUDAS

Task Preferences

Participants were questioned about individual subtasks of the SMRT, CogState and RUDAS to see if there were any favoured tasks. Those that performed multiple tests were also questioned if they preferred one of the tests over another. A few participants stated that they did not have preference for any of the tests performed. Generally, if a participant performed both a verbal and a computerised test, they preferred the computer-based testing. The SMRT appeared to be the least popular amongst participants. Once the procedure was described there was some reluctance at the idea of the SMRT or refusal to proceed. Participants were given the option of another cognitive test or to withdraw from the study. One third of participants in the study declined to have their voice recorded on the consent form and this reduced the choice of cognitive test. Participant P12 (Corsi) suggested that “people feel scared to consent to audio because they don’t know what they are going to say. Give them options to write or record their answers.” Another, Participant P79 (SMRT) was willing to complete the SMRT but not have their voice recorded. Her recollection of the story was transcribed onto paper as the participant was speaking. One participant seemed to feel the need to defend his performance on the story recall, but seemed happier with his CogState performance.

It was observed that some participants appeared to lose concentration, became tired and exhibited signs of boredom whilst conducting the CogState test. According to Participant P32 (CogState) Task 3 "felt like it was dragging on longer than the
other ones. Felt like I was losing my memory." Whereas others preferred CogState over the other tasks performed.

“The card one easier for most people.” P15 CogState and Corsi

"Prefer Corsi Block test over CogState because it is easier to remember." P20 CogState and Corsi

“CogState over the story because I like to learn about computer. The story game was harder than the CogState.” P28 CogState and SMRT

"I liked the game on the computer better" P072 CogState and RUDAS

Whilst some parts of the RUDAS were enjoyed by participants, other parts were confusing, disliked or patronising. For example, participants generally seemed to enjoy the animal task of RUDAS but not repeating the shopping list. The judgement task was also seen as confusing for some.

"I liked the animal part." P1 RUDAS

"Enjoyed listing the animals and remembering the shopping list." P21 RUDAS

"The road question would be a bit funny for other Aboriginals” P24 RUDAS

"[I didn't like] repeating the shopping list. I don’t like talking the same thing over and over. Some people would get angry if asked to repeat over and over." P25 RUDAS

Discussion
This study is one of very few to explore the psychometric properties and acceptability of cognitive tests in an Aboriginal adult population. Overall the
assessments showed reasonable test-retest reliabilities ranging from CogState One Back Accuracy at 0.61 to RUDAS Total Score at 0.86. The SMRT assessments displayed good inter-rater reliability at 0.98 to 0.99. Learning effects were only evident on the first story for the SMRT. The qualitative analysis suggested that the tests appeared to demonstrate face validity as they were viewed as a positive challenge, invoked memories for participants and an opportunity to learn about the mind. However, as in other populations, they also provoked some anxiety and some uncertainty about the purpose, despite the use of detailed explanations and introductions. Participants discussed familiarity of assessment content, format and processes as influences on appropriateness of the tasks. Language, social situations and convalescence were potential impacts on participants' understanding and performance. It was predicted that language would be an important factor for consideration due to the high proportion of participants with English as a second language. Use of Aboriginal languages for the introduction and testing process was proposed to potentially improve acceptability. Ensuring an appropriate introduction by utilising Aboriginal Liaison Officers and non-verbal aides (pictures or hand signals) were also mentioned as means to improving acceptability.
Psychometric Properties

Nunnally and Bernstein (1994) suggest that modest reliability of 0.70 is adequate for early stages of research. Reliability values for experimental group research should be above 0.80 and the standard for individual assessment and clinical decision making 0.90 (Nunnally & Bernstein 1994).

CogState reliability

Iterations of the CogState battery have been used to investigate the effectiveness of repeated measurements, useful for monitoring change in substance use, post-surgery and disease processes (Falleti et al. 2006). The battery has also been used to research mild cognitive impairment, Alzheimer's disease, dementia and concussion in sport investigations (Fredrickson et al. 2010; Maruff et al. 2013; Straume-Naesheim, Andersen & Bahr 2005). Studies assessing detection, identification and one back tasks have reported reliabilities between: .21-.84 (Falleti et al. 2006; Straume-Naesheim, Andersen & Bahr 2005). Test-retest reliabilities in the current study appear comparable to the other studies mentioned.

Dingwall et al. (2009) examined the psychometric properties of CogState detection, identification, one card learning and four other subtasks for repeated testing of healthy Indigenous adolescents (mean age = 15.25 years). The detection reaction time reliability in the current study was comparable to the Dingwall and Cairney (2009) study (r=.65 and r=.66 respectively). However for the identification and one card learning tasks Dingwall and Cairney (2009) found reliabilities between .51-.58 and in the current study reliabilities for the same tasks were between .69-.85.

Subtle differences in procedure existed between the two studies. Dingwall and Cairney (2009) assessed participants in groups opposed to individual assessment in the current study. There may have been low motivation to perform well in the group setting and an inability to monitor closely as there were approximately 15 participants tested together. Qualitative analysis of the current project suggests that individual participants appeared challenged and motivated to perform well, possibly leading to increases in reliability.
Corsi Reliability
The Corsi Block-Tapping Task was developed as a spatial alternative to the verbal Hebb digit task (Corsi 1972). Nine digit number sequences are verbally presented and participants are requested to recall the sequence as a test of working memory (Weitz et al. 2011). Over time, there has been a number of Corsi Block Tapping-Task adaptations developed including physical boards of varying cube numbers and sequence lengths and also computer-based versions (laptop computers and tablets) (Farrell Pagulayan et al. 2006).

A lack of standardised administration and scoring of Corsi Block-Tapping Task adaptations has been suggested as a source of variation across studies in the scores of healthy participants (Kessels et al. 2000). Berch, Krikorian and Huha (1998) state that procedural variation across studies prevents a review of reliability and validity coefficients of Corsi tasks. Use of computer-based tasks has enabled standardisation of administration and scoring allowing for comparisons to be established.

Reliabilities of .48-.90 have been found for various Corsi test versions (Baddeley, Gardner & Grantham-McGregor 1995; Williams et al. 2000). The current study demonstrated modest reliability but not as high as others stated. Reliability results may be attributable to the lack of familiarity with assessment processes or concept of the individual test itself. It has been suggested that acculturation has affected tests of similar nature such as variants of the cube imitation test and the Queensland Test (Kearney 1966; Richardson 2005). Despite potential cultural influences the reliability results suggest that Corsi appears to be a reasonable test for measuring visuospatial working memory in our population of interest.

RUDAS Reliability
Storey et al. (2004a) initially developed the Rowland Universal Dementia Assessment Scale where they obtained test-retest reliability of .98 and inter-rater reliability of .99. The initial study was conducted among hospital outpatients with an English speaking background, Asian non-English background and non-Asian and non-English speaking background at Liverpool Hospital in Sydney (Storey et al. 2004a). The RUDAS has been tested against similar assessments across a variety of
populations with high cross-cultural specificity in immigrant populations (Naqvi et al. 2015). A majority of the studies in Australia concerning the RUDAS have been conducted on urban samples whereas participants of this study were located in rural and remote areas. The RUDAS reliability was the highest of all cognitive tests in the study but comparatively lower than the initial validation study of Storey et al. (2004a). Difference in reliability may have occurred due to demographic characteristics and geographical differences in the sample of participants, rural Aboriginal participants compared to urban participants of varied cultural background.

**SMRT Reliability**

This study used a modified version of the logical memory subtask of the Wechsler Memory Scale. The development of culturally relevant stimulus material has been undertaken in other studies. Baek et al. (2011) studied a Story Recall Test (SRT; An & Chey, 2004), analogous to the Logical Memory subtask of the WMS to determine differences in Alzheimer’s disease and mild cognitive impairment in an older Korean population. It was found that the content in the logical memory subtask was not directly suitable for the Korean population due to language familiarity and cultural differences in word usage (Baek et al. 2011). Brickman, Cabo and Manly (2006) suggests different factors between cultures that may impact upon testing: quality of education, acculturation and literacy, also in line with Baek et al. (2011). Similar to the current study the authors of the SRT developed their own story of 24 words where participants were required to memorise the story after one reading and immediately recall. There were two scoring methods of 'verbatim' and 'gist' employed for the recall tests. Norms were developed for two educational groups (0-6 years and ≥ 7 years) and gender. It was found that the SRT immediate recall correlated well with another measure of verbal memory, the Korean Hopkins Verbal Learning Test ($r = 0.60, p<0.01$). Baek et al. (2011) also found that the SRT was influenced by the level of education obtained by participants.

Modifications based on cultural differences outlined by Baek et al. (2011) and Brickman, Cabo and Manly (2006) would be beneficial for the Australian Aboriginal and Torres Strait Islander context. Other researchers using the Logical Memory
immediate subtask obtained test-retest reliabilities between .58-.81 (Lo et al. 2012; Salthouse & Tucker-Drob 2008; Wechsler 1997). This is suggestive that the SMRT is a sufficiently reliable test to assess verbal memory changes over time in a research setting within this population.

Story 1 of the SMRT was the only test to exhibit practice effects. These effects may have occurred as it was the first of the stories to be administered and thus participants were relatively unfamiliar with the format of the task. Their knowledge of task requirements might therefore have improved by Story 2 following their experience with Story 1. As there were two stories in one session, this allowed for another opportunity to become confident with the test protocol before undertaking the retest, hence increasing performance at the retest. Story 2 was not subject to practice effects possibly due to the experienced gained in Story 1. Potential test anxiety may have decreased due to the opportunity to practice what the test required during Story 1. This was also reflected in comments from participants mentioning length of the stories and favouring the second story as it felt shorter than the first.

**Computerised Reliability**

Computerised testing is purported to have several benefits including standardised administration and scoring, increase the accuracy of response time measurements (Claessen, van der Ham & van Zandvoort 2015), portability and ability to increase in difficulty (Brunetti, Del Gatto & Delogu 2014). There is also capacity to present alternate test forms, randomise stimuli and assess a range of functions in a short period of time (Collie et al. 2003; Makdissi et al. 2001). Dingwall et al. (2010) demonstrated that age and computer familiarity were factors of influence in their study where effects were demonstrated in tasks of learning, memory, psychomotor and executive functions. In regards to the current study this may account for the variation in reliability coefficients across the individual subtasks. Generally the computerised test reliabilities in this study were lower than the non-computer tests potentially due to a lack of exposure and familiarity with computers in the sample. A participant stated that others might worry about a monster jumping out of the screen (Corsi). One participant stated that money is an issue and that people had
mobile phones, not a computer. The computerised tests also had increased potential for interruptions as they were slightly longer than the non-computerised tests and maintained a predetermined, fixed pace which might somewhat explain their reduced reliability. The average administration for the four CogState subtasks was fifteen minutes. This was the longest assessment and had potential for many interruptions as evidenced by the observations recorded. There were no opportunities to pause for interruptions given the self-paced nature of the computer program. Other interruptions such as machine alarms, background noise and visitors had potential to affect reliability. To avoid these issues in the future; signage is proposed requesting staff to avoid interruptions, a dedicated assessment room, conducting testing at nominated 'quiet' times and possibly reduce the number of subtasks.

A CogState subtask, Identification Reaction Time demonstrated higher reliability than the other computerised tasks and one of the highest reliabilities overall. It is theorised that this task is relatively easy to comprehend, compared to some of the others in CogState. A possible justification for the higher reliability is that the Identification task was second in the battery and participants had time to become familiar with the testing platform, develop strategy and a possible decrease in test anxiety (Goldberg et al. 2010). Some participants made specific references to individual tasks that appeared more difficult than others. The third task, One Card Learning, was mentioned by participants as difficult and lengthy. This may have contributed to reduced reliability of the latter tasks. The length of time taken to complete the test may have had an impact on the motivation of participants. In the initial contact with a participant, a great span of time is needed to discuss the procedure, answer questions, set up the testing platform, perform initial practice attempts, perform the scored test and engage in the qualitative interview. The first two tasks of CogState are able to be completed in a timely manner and this might be reflected in the higher reliability results. Boredom and a decline in concentration were observed in some participants particularly in task 3 as it appeared to take the greatest length of time. This also has the potential to influence reliability. Of course,
as interpreters were not available, there is also a risk that participants did not comprehend these latter, slightly more complex tasks.

Corsi and CogState did not exhibit any practice effects and this is consistent with previous studies where it has been suggested that computers reduce potential effects through dual baseline measurements and possess multiple alternate forms (Makdissi et al. 2001; Straume-Naesheim, Andersen & Bahr 2005).

**Inter-rater reliability**

Sullivan (2005) developed six new paragraphs based on the logical memory subtask to explore alternate forms for repeat assessment for auditory-verbal memory. Participants were undergraduate psychology students, a majority female (84%). The six passages obtained inter-rater reliability of .97-.98, comparable to Logical Memory Revised and WMS Third Revision. Similarly, the Korean modified SRT studied by Baek et al. (2011) found inter-rater reliability in a sample of 273 participants of 0.98.

The inter-rater reliability coefficients for the SMRT indicate that over 98% of the variance observed is due to true score variance rather than the difference between raters and these results are comparable to previous studies. The inclusion of verbatim and gist elements were driven by cultural and linguistic reasons in Baek et al. (2011) and the current study. Comprehensive descriptions within the scoring guidelines would suggest objective rating of elements resulting in high inter-rater reliability results.

Aboriginal participants may have had less exposure and familiarity with test procedures and difficulty accessing interpreters in this study may have contributed to the comparably lower reliability. Nevertheless, the reliabilities achieved in this study were acceptable for use of the test in a research setting. This may only indicate a level of consistent performance, not an indication of the tool’s validity to rule in or rule out disease states. Further research is needed to demonstrate the construct validity within a similar population.
Acceptability

Factors related to test delivery; format and content identified in previous research were also identified as factors that impacted on acceptability of the cognitive tests in this study. As expected, language was an important factor impacting on understanding and use of interpreters was a proposed solution for assisting understanding and acceptability.

Use of an interpreter can introduce subtle variations to test administration and scoring. According to Storey et al. (2004b) there are factors to be considered for multilingual test administrators or professional interpreters. A briefing should occur before conducting the assessment including: importance of precise interpretation of instructions and participant responses, also requesting the interpreter to note occasions where participant performance may have been affected by changes to the test due to language or cultural factors (Storey et al. 2004b). Multilingual administrators should be aware of the possible difficulty of reading in one language and speaking in another, also acknowledgement of differences between formal and informal word usage when translating and recording the participant’s response.

This project was unable to utilise the Aboriginal Liaison Officers or the Aboriginal Interpreter Service at Alice Springs Hospital (further account is discussed in the limitations section of the paper). Staff from Alice Springs Hospital were requested to consider proficiency with English in their referrals of potential participants. This may have influenced obtaining adequate reliabilities on the cognitive assessments and increased efforts to engage qualified interpreters should be made in future studies. Nevertheless, this potentially reflects ‘real world’ conditions as qualified interpreters are not always utilised, especially where English comprehension is perceived as adequate.

Participants relayed feelings of frustration when an answer was perceived to be wrong. It was observed that some of the participants performing CogState were influenced by hearing the audible error noise from the program. Performance anxiety was discussed but viewed in the context that it maintained the individual’s motivation. The game-like nature of the tests appeared to encourage motivation for
individuals to perform well in comparison to their previous performance. Participants expressed concern over factors perceived to impact their performance such as past head injuries, drug use or current illness. It was implied that performance would improve if these factors were not an issue.

**Cultural context of assessment**

There are a number of cultural variations between Indigenous people and non-Indigenous people that may lead to differences in views on cognitive test performance. A lesser emphasis on competitive behaviour (1982) and a different view on the concept of time are factors that could have impacted upon the acceptability of the cognitive tests used this study. A CogState participant described the uncertainty of instantaneous decision making in the assessment and contrasts to 'normal life.' They discussed how the test forced them into an immediate decision and that in a regular situation they would have more time to consider the options. Less consistent computer reliabilities are an indication that the format of the tests may not be as appropriate to Aboriginal people due to differences in philosophical perspectives or lack of familiarity to the stimulus. Harris and Harris (1988) discuss views on Aboriginal learning styles where there is a preference for knowledge based on a tangible context as opposed to abstract principles, to observe rather than be guided by oral or written instruction and deferment to an elder with more experience and knowledge. This is evident in a Corsi participant's suggestion to have a trusted community member or Liaison Officer explain the test process. It is thought that the participant was inferring that the language and or concept of testing may not have been a directly translatable idea in Aboriginal culture. Other participants also expressed uncertainty about the existence of equivalent words such as left and right (in regards to the RUDAS body orientation task). A preference for concrete explanations was apparent in participant responses describing how to explain testing to another person. It was suggested that pictures should be used initially, then performance of a practice run and explanation of the instructions in a stepwise manner. There were concerns that others may not understand the purpose and function of the test as the computer was not physically shown at the time of introduction. To overcome some of these issues it is proposed
to have test administrator demonstrations and longer participant practice sessions. Participants themselves suggested an increased use of pictures or hand signals. These suggestions have historically been used as a means to reduce effects of language and cultural differences (Kearney 1966).

**Limitations**

A small number of patients meeting inclusion and exclusion criteria was a limiting factor, therefore several participants performed up to three cognitive tests. An opportunity to perform several assessments increased participant exposure to the process and may have altered their perspectives or comfort level with the assessments. Performance of multiple assessments could also be considered a positive aspect as participants were able to make comparisons between assessments and determine which was more acceptable. Each cognitive test also assessed different participants; possibly introducing systematic error and limiting reliability result comparison. However, analyses determined that there were no significant differences in the demographic characteristics of the participants across cognitive assessment. It was intended to compare the lost to follow up and test-retest participant characteristics to determine if those retained in the study were representative of the whole sample. However, sample sizes of those lost to follow up per assessment were deemed too small for valid analysis.

The study attempted to respect Aboriginal cultural practices of participants but there may have been some oversight. Gender is a significant concept that influences societal communication for Aboriginal and Torres Strait Islander people. Particular health issues are often managed by gender and there are also practices that limit male and female interaction. As a younger female researcher it may have been useful for older Aboriginal male participants to be assessed by a male; however there was no male researcher available for this study.

Language diversity of staff and participants at ASH highlighted the importance of plain English instructions. After initial consent discussions it was apparent that staff
occasionally referred participants who did not meet the requirement of fluent/conversational English for the study. The Aboriginal Liaison Officers at ASH were consulted in the development stages of this project however they were unable to assist due to resource restrictions. To increase cultural safety for future studies, Aboriginal Liaison Officers or the Aboriginal Interpreter Service should be consulted for participant introductions and to aid in building rapport. It would also be advantageous to have male and female researchers, including researchers of Aboriginal descent to respect cultural practices of Aboriginal participants. If this study was to be extended; it would be beneficial for a supplementary test to be conducted to determine English skills and basic understanding of the assessment process before testing. This will help determine if the Aboriginal Liaison Officer Unit or Aboriginal Interpreter Service assistance is needed. Regardless, the issue of availability of trained, adequately qualified interpreters remains a challenge in this context but it is somewhat encouraging that reasonable reliabilities can be observed without the use of interpreters.

**Further Research**

This study examined the psychometric properties of reliability and acceptability. Further projects should investigate validity of these tests to determine whether they are measuring the constructs of interest. These constructs are the cognitive domains of psychomotor function, visual attention, working memory, visual learning, visuospatial working memory, memory, praxis, language, judgement, drawing, body orientation and auditory verbal learning. It is suggested that this study protocol be executed within different Aboriginal communities to assess whether culture, language or geographic location have any bearing on the acceptability and reliability results. LoGiudice et al. (2006) suggested that these aspects are part of the challenges in adapting and validating cognitive tools for Aboriginal and Torres Strait Islanders. Future research should examine whether reliability increases with appropriate language modifications or translations. There should also be research into forming culturally appropriate, Aboriginal and Torres Strait Islander norms to improve clinical assessment in this population. Cross-
cultural research in cognitive testing has demonstrated that norms developed within a certain population may not be applicable to other populations despite matching for demographic factors (Ardila 2005; Richardson 2005). Ardila (2005) suggests there are culture-dependent factors that motivate cognitive testing and these include: relationships within a social structure (individuals, community, and role-based authority figures), competition and performance values (including speed), use of specific testing elements, types of communication and interpersonal behaviour (privacy values). These factors should be considered when selecting and designing cognitive tests for Aboriginal and Torres Strait Islander people. There have been studies on developing specific norms for adolescents and the elderly however a gap exists for the adult population. The opportunities mentioned for future research should be conducted with input, consultation and collaboration with Aboriginal and Torres Strait Islander people.

**Implications and conclusion**

This study demonstrated just adequate test-retest reliability for the three CogState subtasks (detection, one card learning and one back task) and the Corsi test for research purposes. The individual SMRT tests, CogState identification reaction time and RUDAS total score demonstrated good reliability for research purposes. In conjunction with the reliability results qualitative data suggested that some aspects of the tests chosen were generally acceptable to the study sample, while other aspects were less so. The results of this study will contribute to the knowledge base on effective cognitive assessment for Aboriginal and Torres Strait Islander people. Results may provide new knowledge regarding reliabilities of specific tools to assist researchers and potentially clinicians in selecting the most appropriate assessments for their Aboriginal and Torres Strait Islander participants or clients. This will hopefully lead to more accurate and reliable assessments of cognitive function for clients to seek early access to treatments, avoid unnecessary testing and obtain appropriate care.
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Appendices

Appendix A: Adapted CogState Brief Battery Instructions

Before each task I will give you a short instruction. Please do not press any buttons until I tell you to.

Detection Task – Has the Card Turned Over?
The first one is practice.

You will see a playing card face down on the screen.

You need to press ‘yes’ as soon as the card turns over (indicate turning a card with your hand).

This is the ‘yes’ key (Point to the yes key)

As soon as you see the Joker, press ‘yes’.

If you make a mistake, you will hear a beep.

Try to go as fast as you can without making any mistakes.

Press Enter when you are ready to start.

(If they need help, indicate the yes button. As the cards start showing, remind the participant to press yes as soon as they see each card turn face-up.)

That was your practice, now it’s the real thing. Do the same thing again. Press Enter when you are ready to start.

Identification Task – Is the Card Red?
OK, now for the next one. You get a practice first.

It’s called “Is the card red?”

You will need to use both the ‘yes’ and ‘no’ buttons for this task.
You will see a playing card face down on the screen.

When the card turns over (*indicate turning a card with your hand*)

Press ‘yes’ if it is red or ‘no’ if it is black.

(*Guide patient to the right keys*)

If you make a mistake, you will hear a beep.

Try to go as fast as you can without making any mistakes.

Press Enter when you are ready.

(*If they need help, indicate the yes and no buttons. As the cards start showing, remind the participant to respond as soon as they see each card turn face-up.*)

Well done, now it’s the real thing. Same thing again. Press Enter when you are ready.

**One Card Learning Task – Have you seen this card before?**

This test is called “Have you seen the card before?”

First you get a practice.

In this task you have to try and remember all of the cards that come up.

So, you will see a playing card on the screen. When the card turns over (*indicate turning a card with your hand*) think, have I seen this card before in this task?

If you have seen the card before in this task, press yes. If you haven’t seen the card before, press no.

If you make a mistake, you will hear a beep.

Try and go as fast as you can without making any mistakes.
When you are ready press enter.

The first one you see will be 'no' as you haven’t seen any cards yet.

*(If they need help, indicate the yes and no buttons. As the cards start showing, remind the participant to respond as soon as they see the card turn face-up.)*

Well done! Now you are going to do the real thing. This test has all new cards. Press Enter when you are ready.

*One Back Working Memory Task – Is the last card the same?*
This one is called “Is the card the same?”

You get to practice first.

You will see a playing card on the screen.

When the card turns over *(indicate turning a card with your hand)* think “is this card the same as the one just before it?”

If the card is exactly the same as the one before it press ‘yes’.

If it is not the same as the one before it, press ‘no’.

The first one will be 'no'.

If you make a mistake, you will hear a beep.

Try to go as fast as you can without making any mistakes.

*(If they need help, indicate the yes and no buttons. As the cards start showing, remind the participant to respond as soon as they see the card turn face-up.)*

Great. That was your practice, now for the real thing. Press Enter when you are ready. Do the same thing again.
Appendix B: Adapted Corsi Block-Tapping Task Instructions

This is a game on the computer that measures memory.

You will see some blue squares on the screen like this. (Show picture)

Some will light up yellow one at a time. (Point to yellow square).

You need to remember the order in which they light up.

When they are finished lighting up, you need to copy the order they lit up in by touching them on the screen (indicate on picture – “so if this one yellow, then this one, you would press here then here”)

When you finish, click the button that says DONE.

The test gets harder as you go along. More squares will light up each time.

If you cannot remember the order, then just try as best you can.

First there is a practice test.

Press go when you are ready to start the practice.

(During the practice run, prompt to “push harder”, “click done”, “wait until the pattern is complete” if needed)

Good. So that was your practice, now we will do the real thing.
Appendix C: Corsi Block-Tapping Task Screenshot
# Appendix D: Corsi Block-Tapping Task Result Form

**Corsi Blocks Assessment**

| Study ID: | 
|----------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|          | CORSI BLOCKS ASSESSMENT |          |          |          |          |          |          |

<table>
<thead>
<tr>
<th></th>
<th>Baseline Day 1</th>
<th>Day 3 or 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date (dd/mm/yy)</td>
<td>/ /</td>
<td>/ /</td>
</tr>
<tr>
<td>Time (24hr format)</td>
<td>: hrs</td>
<td>: hrs</td>
</tr>
<tr>
<td>Block Span</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Correct Trials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memory Span</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time taken to complete</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

75
Appendix E: Adapted Rowland Universal Dementia Assessment Scale Instructions

Introduction
Are you comfortable/ok?

Can you hear me ok? Do you have any hearing problems?

Do you have any seeing/eye problems? Do you wear glasses?

I’m going to ask you some questions. This will help us see if these are good questions for other people.

Memory
I want you to imagine we are going to the shops. We have to buy four things and I need you to remember the shopping list. When we get to the shops in about 5 minutes I will ask you what we need to buy. Can you remember this list for me? It is:

TEA, COOKING OIL, EGGS, SOAP

Can you say the shopping list for me?

Please repeat the list for me so we can remember it together.

One more time so we really remember the list.

Body Orientation
I am going to ask you to show me parts of the body. Please:

1. Show me your RIGHT foot
2. Show me your LEFT hand
3. With your RIGHT hand touch your LEFT shoulder
4. With your LEFT hand touch your RIGHT ear
5. Point to MY LEFT knee
6. Point to MY RIGHT elbow
7. With your RIGHT hand point to MY LEFT eye
8. With your LEFT Hand point to my LEFT FOOT
**Praxis**
I am going to move my hands. Watch me moving my hands. Can you copy me? Can you move your hands in the same way?

Put both hands flat on your knees.

Make a fist with one hand facing up *(demonstrate a vertical fist)* like this, and keep your other hand flat. I want you to do this just like I did.

Now swap hands, like this.

Now do it with me. I would like you to keep doing this at this pace till I tell you to stop.

**Drawing**
Please draw this picture for me, as well as you can?

**Judgement**
Imagine, you are standing next to a busy street (lots of cars) (like outside, here at the hospital). There is no crossing and no traffic lights. How do you get to the other side of the street without getting hurt (safely)?

**Memory (Recall)**
Ok we are now at the shops. Can you tell me the list of things we need to buy?

**Language**
We are nearly finished. I want to ask you one more. Can you tell me the names of different animals, as fast as you can? They can be pets, wild or animals that you eat. I am going to time you for one minute.

**END**
Ok. Thank you. We are done with that activity.
Appendix F: Rowland Universal Dementia Assessment Results Sheet

<table>
<thead>
<tr>
<th>Item</th>
<th>Max Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Memory</strong></td>
<td></td>
</tr>
<tr>
<td>1. (Instructions) I want you to imagine that we are going shopping. Here is a list of grocery items. I would like you to remember the following items which we need to get from the shop. When we get to the shop in about 5 mins. time I will ask you what it is that we have to buy. You must remember the list for me. Tea, Cooking Oil, Eggs, Soap. Please repeat this list for me (ask person to repeat the list 3 times). (If person did not repeat all four words, repeat the list until the person has learned them and can repeat them, or, up to a maximum of five times.)</td>
<td></td>
</tr>
<tr>
<td>2. I am going to ask you to identify/ show me different parts of the body. (Correct = 1). Once the person correctly answers 5 parts of this question, do not continue as the maximum score is 5.</td>
<td></td>
</tr>
<tr>
<td>(1) show me your right foot</td>
<td>.......1</td>
</tr>
<tr>
<td>(2) show me your left hand</td>
<td>.......1</td>
</tr>
<tr>
<td>(3) with your right hand touch your left shoulder</td>
<td>.......1</td>
</tr>
<tr>
<td>(4) with your left hand touch your right ear</td>
<td>.......1</td>
</tr>
<tr>
<td>(5) which is (indicate/point to) my left knee</td>
<td>.......1</td>
</tr>
<tr>
<td>(6) which is (indicate/point to) my right elbow</td>
<td>.......1</td>
</tr>
<tr>
<td>(7) with your right hand indicate/point to my left eye</td>
<td>.......1</td>
</tr>
<tr>
<td>(8) with your left hand indicate/point to my left foot</td>
<td>.......1</td>
</tr>
<tr>
<td><strong>Praxis</strong></td>
<td>.......5</td>
</tr>
<tr>
<td>3. I am going to show you an action/exercise with my hands. I want you to watch me and copy what I do. Copy me when I do this . . . . (One hand in flat, the other palm down on table - alternate simultaneously.) Now do it with me. Now I would like you to keep doing this action at this pace until I tell you to stop - approximately 10 seconds. (Demonstrate at moderate walking pace).</td>
<td></td>
</tr>
<tr>
<td>Score as:</td>
<td></td>
</tr>
<tr>
<td>Normal = 2 (very few if any errors; self-corrected, progressively better; good maintenance; only very slight lack of synchrony between hands)</td>
<td></td>
</tr>
<tr>
<td>Partially Adequate = 1 (noticeable errors with some attempt to self-correct; some attempt at maintenance; poor synchrony)</td>
<td></td>
</tr>
<tr>
<td>Failed = 0 (cannot do the task; no maintenance; no attempt whatsoever)</td>
<td></td>
</tr>
<tr>
<td><strong>Visualconstructional Drawing</strong></td>
<td>.......2</td>
</tr>
<tr>
<td>4. Please draw this picture exactly as it looks to you (Show cube on back of page). (Yes = 1)</td>
<td></td>
</tr>
<tr>
<td>Score as:</td>
<td></td>
</tr>
<tr>
<td>(1) Has person drawn a picture based on a square?</td>
<td>.......1</td>
</tr>
<tr>
<td>(2) Do all internal lines appear in person's drawing?</td>
<td>.......1</td>
</tr>
<tr>
<td>(3) Do all external lines appear in person's drawing?</td>
<td>.......1</td>
</tr>
<tr>
<td><strong>Judgment</strong></td>
<td>.......3</td>
</tr>
<tr>
<td>5. You are standing on the side of a busy street. There is no pedestrian crossing and no traffic lights. Tell me what you would do to get across to the other side of the road safely. (If person gives incomplete response that does not address both parts of answer, use prompt: &quot;Is there anything else you would do?&quot;&quot;) Record exactly what patient says and circle all parts of response which were prompted.</td>
<td></td>
</tr>
<tr>
<td>Score as:</td>
<td></td>
</tr>
<tr>
<td>Did person indicate that they would look for traffic? (YES = 2; YES PROMPTED = 1; NO = 0)</td>
<td>.......2</td>
</tr>
<tr>
<td>Did person make any additional safety proposals? (YES = 2; YES PROMPTED = 1; NO = 0)</td>
<td>.......2</td>
</tr>
</tbody>
</table>
Memory Recall

1. (Recall) We have just arrived at the shop. Can you remember the list of groceries we need to buy?
(Prompt: If person cannot recall any of the list, say “The first one was tea.”) (Score 2 points each for any item recalled which was not prompted – use only “tea” as a prompt.)

<table>
<thead>
<tr>
<th>Item</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tea</td>
<td>2</td>
</tr>
<tr>
<td>Cooking Oil</td>
<td>2</td>
</tr>
<tr>
<td>Eggs</td>
<td>2</td>
</tr>
<tr>
<td>Soup</td>
<td>2</td>
</tr>
</tbody>
</table>

Language

6. I am going to time you for one minute. In that one minute, I would like you to tell me the names of as many different animals as you can. We’ll see how many different animals you can name in one minute. (Repeat instructions if necessary). Maximum score for this item is 8. If person names 8 new animals in less than one minute there is no need to continue.

<table>
<thead>
<tr>
<th>Animal 1</th>
<th>Animal 2</th>
<th>Animal 3</th>
<th>Animal 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOTAL SCORE = 8

/30
Appendix G: Rowland Universal Dementia Assessment Scale
Administration and Scoring Guide
Table of Contents

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<td>20</td>
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<td>21</td>
</tr>
<tr>
<td>Scoring</td>
<td>21</td>
</tr>
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<td>Item 6 – Language</td>
<td>22</td>
</tr>
<tr>
<td>Notes</td>
<td>23</td>
</tr>
<tr>
<td>Scoring</td>
<td>23</td>
</tr>
<tr>
<td>Final Scoring</td>
<td>24</td>
</tr>
</tbody>
</table>
Introduction

The Rowland Universal Dementia Assessment Scale (RUDAS): A Multicultural Cognitive Assessment Scale – (Storey J, Rowland J, Basic D, Conforti D & Dickson H [2004] International Psychogeriatrics, 16(1) 13-31) is a short cognitive screening instrument designed to minimise the effects of cultural learning and language diversity on the assessment of baseline cognitive performance.

When administering the RUDAS it is important that the respondent is encouraged to communicate in the language with which they are most competent and comfortable.

Test administrators should read the following instructions carefully before using the RUDAS.
The Assessment Context – General Guidelines:

Test Anxiety

- Make sure the test taker is as relaxed as possible, as test anxiety can interfere with performance on cognitive tests.

Hearing

- Conduct the RUDAS in a quiet area and make sure the test taker can hear clearly. It is important to identify at the beginning of the assessment if the test taker has impaired hearing and accommodate for this as much as possible by speaking slowly and clearly. Encourage the test taker to wear any hearing aids. Be careful not to speak too loudly as this may result in distortion. (There is a large print version of the RUDAS for test takers with severe hearing impairment).

Vision

- Ensure that the test taker is using reading glasses where necessary and that there is sufficient light in the room.

Seating

- Sit opposite the test taker. This is important for communication reasons as well as controlling for the difficulty of some items on the RUDAS. Do not sit behind a desk, as this will inhibit the giving of instructions for some items on the RUDAS and may also be intimidating for the test taker.

Recording Responses

- It is important to record the test taker’s full response to each item.

Physical Disability

- For test takers who have a physical disability (e.g. vision, hearing, hemiparesis, amputee, stroke, aphasia) which may affect their ability to perform certain items on the RUDAS, it is important to complete the RUDAS as fully as possible but to interpret any total score less than 22 with caution (further research is necessary to assess validity of the RUDAS in this sub-group of patients)
The Language/ Cultural Context:

Using a Professional Interpreter

If you are utilising a professional interpreter to administer the RUDAS it is important to consider the following:

1. Interpreters should be used in all situations where the test taker's preferred language is not spoken fluently by the test administrator.

2. Make sure that the language spoken by the interpreter (including the dialect) is the same one with which the test taker is familiar.

3. It is important to explain to the test taker that the interpreter is the facilitator and that you will be asking the questions. This may help to avoid confusion during the assessment.

4. It is better for the interpreter to sit next to the test administrator while the test taker sits opposite. This will reinforce the adjunctive role of the interpreter and make it easier for the test taker to synthesise the non-verbal cues from the test administrator and the verbal cues from the interpreter.

5. It is important to brief the interpreter before starting the assessment:

- The interpreter should be aware of the general nature of the interaction i.e. that it is a cognitive assessment

- Remind the interpreter of the importance of concurrent and precise interpreting. Explain that your instructions and the test taker’s responses should be interpreted as exactly as possible.

- Ask the interpreter to take note of any instances during the assessment where the test taker’s performance may have been affected by subtle or unintended changes to the meaning of the test instructions due to language or cultural factors

- Inform the interpreter that it may be necessary at the end of the test for you to clarify a concept covered in the assessment to further make the distinction between the test taker’s actual cognitive capacity and potential cultural bias which may arise as a result of the translation process.
Multilingual Test Administrators

If, as the test administrator, you are multilingual it is important to consider all of the same issues which are relevant to the use of a professional interpreter, as well as the following:

- You may need to be careful when translating the RUDAS questions as you might find it more difficult when you have to read in one language and speak in another.

- It is important that you translate the RUDAS questions precisely. Be aware of the differences between formal and informal word usage when translating the RUDAS instructions and recording the test taker’s responses.
1. I want you to imagine that we are going shopping. Here is a list of grocery items. I would like you to remember the following items which we need to get from the shop. When we get to the shop in about 5 minutes time I will ask you what it is that we have to buy. You must remember the list for me.

Tea
Cooking Oil
Eggs
Soap

Please repeat this list for me (Ask person to repeat the list 3 times). (If person did not repeat all four words, repeat the list until the person has learned them and can repeat them, or, up to a maximum of five times.)
Notes:

- Important to give enough learning trials so that test taker registers and retains the list as well as they can (max. of 5 learning trials)

- Ask the test taker to repeat the list back to you at least three times until they can repeat it correctly or as well as they are going to

- Use realistic nature of the scenario and a little humour (if appropriate) to build rapport and make the task less confrontational i.e. WE are going shopping; I am relying on YOU to remember the list FOR ME, so don’t forget. When WE get to the shop . . .

- To facilitate learning of the list, use your fingers to list off items on the list when teaching it to the test taker to make the task as concrete as possible e.g. thumb = tea, index finger = cooking oil etc.

Scoring:

This is the learning part of the memory question. There are no points for this part of the question but the memory recall component later in the test has a maximum score of 8 points.
Item 2 - Body Orientation

Body Orientation

2. I am going to ask you to identify/show me different parts of the body. *(Correct = 1, Incorrect = 0).*

Once the person correctly answers 5 parts of this question, do not continue as the maximum score is 5.

(1) show me your right foot ......1
(2) show me your left hand ......1
(3) with your right hand touch your left shoulder ......1
(4) with your left hand touch your right ear ......1
(5) which is (point to/indicate) my left knee ......1
(6) which is (point to/indicate) my right elbow ......1
(7) with your right hand point to/indicate my left eye ......1
(8) with your left hand point to/indicate my left foot ......1
Notes:

- Important to sit opposite the test taker (controls for difficulty of the tasks)
- There doesn’t need to be a lot of explanation before starting, just say “I am going to ask you to indicate various parts of the body . . .” - the task is explicit as it evolves

Scoring:

- Although there are 8 parts, this item has a maximum score of 5 points. Once the test taker has 5 correct answers there is no need to continue.
- Be careful with scoring - remember you are sitting opposite the test taker - it is easy to make mistakes so concentrate to make sure you score the person accurately
- There are no half marks, the test taker must get each task 100% correct to be marked correct (e.g. if test taker is asked “with your right hand indicate my left eye” and they use their left hand but still point to your left eye - mark as incorrect)
### Item 3 - Praxis

**Fist / Palm**

3. I am going to show you an action/exercise with my hands. I want you to watch me and copy what I do. **Copy me when I do this . . .** (i.e. demonstrate - put one hand in a fist, and the other hand palm down on the table or your knees and then alternate simultaneously.) **Now do it with me.** I would like you to keep doing this action at this pace until I tell you to stop - approximately 10 seconds or 5 – 6 sequences. (Demonstrate at moderate walking pace).

Score as:

<table>
<thead>
<tr>
<th>Score</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>2</td>
<td>(very few if any errors; self-corrected; progressively better; good maintenance; only very slight lack of synchrony between hands)</td>
</tr>
<tr>
<td>Partially Adequate</td>
<td>1</td>
<td>(noticeable errors with some attempt to self-correct; some attempt at maintenance; poor synchrony)</td>
</tr>
<tr>
<td>Failed</td>
<td>0</td>
<td>(cannot do the task; no maintenance; no attempt whatsoever)</td>
</tr>
</tbody>
</table>
Notes:

- It is important to sit opposite the test taker (controls for difficulty of the task)

- When teaching the task use the following steps:

Step 1: I want you to put your hands on your knees like this (i.e. put both your hands palm down on your knees (i.e. if no table surface))

Step 2: Now watch carefully as I do this (put one hand in a fist in the vertical position and leave the other hand palm down) - I want you to do this just like I did.

Step 3: Watch me again now as I am doing this (alternate hands simultaneously - one in a fist and the other palm down and keep alternating for 5 - 6 trials).

Step 4: Ask test taker to copy exactly what you are doing. If test taker is confused and has not learned the task successfully then repeat Steps 1, 2 and 3

Step 5: Once test taker has learned the task (i.e. understands as well as possible what they are meant to do - regardless of whether or not they can do it 100%), ask them to repeat the exercise at the pace you demonstrate until you tell them to stop (now demonstrate task - intervals between change of hands should reflect moderate walking pace). Do not allow the test taker to copy you when scoring – must demonstrate the task independently.
Scoring:

This question has a maximum score of 2 points.

In order to help distinguish between the three levels of competence, refer to the following:

<table>
<thead>
<tr>
<th>Score</th>
<th>Fist / Palm Integrity</th>
<th>No. of Errors</th>
<th>Fluency</th>
<th>Ability to Self-Correct</th>
<th>Progressive Improvement</th>
<th>Synchrony</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Good adherence to 'palm down' and 'fist' actions with few intrusions or incorrect variations</td>
<td>Minimal</td>
<td>Good</td>
<td>Good</td>
<td>Clearly evident</td>
<td>Only very slight lack of synchrony</td>
</tr>
<tr>
<td>Partially Adequate</td>
<td>Obvious intrusions and incorrect variations in 'palm down' and 'fist' actions</td>
<td>Noticeable</td>
<td>Some attempt to maintain</td>
<td>Some attempt</td>
<td>Some indication</td>
<td>May be noticeable lack of synchrony</td>
</tr>
<tr>
<td>Failed</td>
<td>Barely able to identify correct 'palm down' and 'fist' actions because of many intrusions and incorrect variations</td>
<td>Many</td>
<td>Poor or none</td>
<td>None</td>
<td>Very little or none</td>
<td>Little or no synchrony</td>
</tr>
</tbody>
</table>

Normal

A person who performs normally on this task should exhibit signs of intact learning and should be able to replicate clearly, the 'fist in the vertical position' and 'palm down' actions. Their performance on the task should improve with progressive learning trials to a point where they can do the task fluently with minimal errors. The test taker should demonstrate the ability to self-correct, show progressive improvement over the course of the task and have only very slight lack of synchrony between the hands.

Partially Adequate

A person whose response is partially adequate will make noticeable errors e.g. occasionally places palm up instead of palm down or may place palm up instead of converting to the fist or may form the fist in the horizontal position. They may have to stop occasionally in order to self-correct but even if they are unable to perform the task perfectly there should be some evidence that they have learned the task, some attempt to self-correct and some indication of an attempt to maintain the fluency of the alternating hands. There may be a noticeable lack of synchrony between the hands.

Failed

A person who fails this task shows very little if no ability to understand and execute the task. There are many errors, very little or no evidence of improvement, inability to self-correct, poor maintenance, and obvious inability to emulate correct hand positions and to perform the simultaneous changing of hands with any synchrony. A person who fails may not be able to form a fist or distinguish between palm up and palm down, may not alternate the actions across hands and may not be able to use both hands together at all.
4. Please draw this picture exactly as it looks to you (Show cube on back of page). 
   (Yes = 1; No = 0)
Score as:

(1) Has person drawn a picture based on a square? .......1
(2) Do all internal lines appear in person's drawing? .......1
(3) Do all external lines appear in person's drawing? .......1

....../3
Notes:

This question has a maximum of 3 points.

- Show test taker cue card of cube drawing
- If there is no cue card, the test administrator can draw the cube onto plain (not lined) paper.
- Make sure that test taker can see the drawing clearly (check that they are wearing prescription glasses if applicable)
- Ask test taker to draw the picture of the cube as well as they can
**Scoring:**

*Has test taker drawn a picture based on a square? (i.e. There is a square somewhere in the drawing)*

YES / NO

*Do all internal lines (i.e. dark lines) appear in test taker's drawing?*

YES / NO

i.e.

*Do all external lines (i.e. dark lines) appear in test taker's drawing?*

YES / NO

i.e.
Item 5 - Judgement

Judgement - Crossing the Street

5. You are standing on the side of a busy street. There is no pedestrian crossing and no traffic lights. Tell me what you would do to get across to the other side of the street safely. (If person gives incomplete answer use prompt: 'Is there anything else you would do?') Record exactly what patient says and circle all parts of response which were prompted.

...........................................................................................................................................................................................

........................................................................................................................................................................................................

Score as:
Did person indicate that they would look for traffic? ..... 2
(YES = 2; YES PROMPTED = 1; NO = 0)

Did person make any additional safety proposals? ..... 2
(YES = 2; YES PROMPTED = 1; NO = 0)

..../4
Notes:

- If the test taker gives no response to the question or says "I don’t know", then repeat the question once only.

- Except where the test taker answers both parts of the question on the first attempt, use the prompt 'Is there anything else you would do' in all situations. This is to gain as complete a response as possible from the test taker.

- Use only the general prompt 'Is there anything else you would do' – do not prompt the person in any other way.

- Record test taker's response to this question.

- Circle any part of test taker’s response which was prompted and score accordingly.

- If the test taker says that they never cross the road by themselves (e.g. they are in a wheelchair or their eyesight is poor), then ask them the question again but modify as follows:

“What would anyone who wanted to cross the road have to do to get across safely?”
**Scoring:**

This item has a maximum score of 4 points. Each of the two parts:

1. look for traffic, and
2. additional safety proposal

has a total score of 2 points i.e. Yes = 2; Yes Prompted = 1; No = Zero

i.e.

- Did test taker indicate that they would look for traffic?

<table>
<thead>
<tr>
<th>YES / YES PROMPTED / NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Examples of Correct Responses</th>
<th>Examples of Incorrect Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>I would look for traffic.</td>
<td>Just go across.</td>
</tr>
<tr>
<td>Look left and right.</td>
<td>Put my hand up so the traffic knows I want to cross.</td>
</tr>
<tr>
<td>Check the cars.</td>
<td>Go to the corner and cross.</td>
</tr>
<tr>
<td>Check that it's clear.</td>
<td>Wave at the cars so they can see me.</td>
</tr>
<tr>
<td>Go across when there is nothing coming.</td>
<td>I wouldn't go across.</td>
</tr>
</tbody>
</table>

- Did test taker make any additional safety proposals in road crossing scenario?

<table>
<thead>
<tr>
<th>YES / YES PROMPTED / NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Examples of Correct Responses</th>
<th>Examples of Incorrect Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross to the middle of the road and then look again to make sure there was no traffic before going right across.</td>
<td>Run as fast as I can.</td>
</tr>
<tr>
<td>Keep looking for traffic while crossing.</td>
<td>Cross when the walk sign is green.</td>
</tr>
<tr>
<td>Go across quickly but without running.</td>
<td>Cross at the crossing.</td>
</tr>
<tr>
<td>Be careful.</td>
<td>Just put my head down and go.</td>
</tr>
<tr>
<td>Wait till I could cross with some other people.</td>
<td>Ask for help.</td>
</tr>
</tbody>
</table>
Scoring Examples:

Example 1

“I don’t know. (Repeat the question).

“I’d look for the cars. I can’t think of anything else except be careful.”

This response would score 3 points out of a total of 4 because the person said that they would look for the cars (2/2) and when prompted (i.e. circle indicates that it was prompted) said that they would be careful (1/2) i.e. 2/2 + 1/2 = 3/4

Example 2

“Just go across. Check for the cars.”

This response would score 1 point only out of a total of 4 because the first part of the answer ‘just go across’ was incorrect (0/2), and the second part of the answer ‘check for the cars’ while correct, was prompted (i.e. because it was circled to indicate that it was prompted) (1/2) i.e. 0/2 + 1/2 = 1/4

Example 3

“Put my hand up so the traffic knows I want to cross and then walk to the middle of the road before going right across.”

This response would score 2 points out of a total of 4 because the first part of the answer is incorrect (0/2) and the second part of the answer ‘then walk to the middle of the road before going right across’ is correct (2/2) i.e. 0/2 + 2/2 = 2/4
1. We have just arrived at the shop. (Can you remember the list of groceries we need to buy? (Prompt: If person cannot recall any of the list, say “The first one was ‘tea’.”)

(Score 2 points each for any item recalled which was not prompted.)

Circle ‘Tea’ if used as a prompt and score as 0 out of 2)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tea</td>
<td>2.0</td>
</tr>
<tr>
<td>Cooking Oil</td>
<td>2.0</td>
</tr>
<tr>
<td>Eggs</td>
<td>2.0</td>
</tr>
<tr>
<td>Soap</td>
<td>2.0</td>
</tr>
</tbody>
</table>

.../8
Notes:

- Ask test taker to repeat the 4 items on the grocery list.

- If after 20 - 30 seconds the test taker cannot remember learning the list OR any of the items on the list then use the prompt - i.e. the first one was ‘tea’ and then circle ‘tea’ or write a ‘P’ in parentheses after it to indicate that it was prompted and score as zero.

- Use the prompt ‘the first one was ‘tea’, only if the person cannot remember any of the grocery items.

- Do not use any other prompts in this task (e.g. if the person says ‘cooking oil’ but cannot remember any of the other grocery items on the list do not use the ‘tea’ prompt or any other prompt).

Scoring:

The recall component of the memory item has a maximum score of 8 points.

- There are no part marks, the person scores either zero or 2 points for each item on the grocery list.

- If ‘tea’ was used as a prompt then the maximum score the person can get on this task is 6/8.

- Mark as correct if the person says ‘cooking oil’ or ‘oil’.
**Language Generativity – Animal Naming**

6. I am going to time you for one minute. In that one minute, I would like you to tell me the names of as many different animals as you can. We’ll see how many different animals you can name in one minute. (Repeat instructions if necessary). Maximum score for this item is 8. If person names 8 new animals in less than one minute there is no need to continue.

|   | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | .......8 |
|---|---|---|---|---|---|---|---|---|---|---|


Notes:

This item has a maximum score of 8 points.

- Time the test taker for one minute ONLY - make sure that it is clear to the test taker when to start i.e. "When I say 'Go' you should start listing animals. Don't worry about me writing them down, say the animals as quickly as you can."

- If test taker does not speak English make sure that interpreter also understands the instructions and the importance of simultaneous interpreting.

Scoring:

- If test taker says for example – 'big horse' and 'little horse', then record these as two separate animal names. Then at the end of the assessment, if the person is from an NESB country, check with the interpreter that these two names actually represent different concepts in the relevant language (e.g. in English – 'big horse' and 'little horse' are not separate animal names therefore an ESB person would score only one point (BUT, if the ESB person had said 'horse' and 'foal' then these are two separate concepts and the person would score two points). An NESB person depending on the language spoken may score two points if they used the correct two words for 'big horse' and 'little horse'. It is important here to distinguish between perseveration (i.e. repetition of the same animal name) and linguistic peculiarities of different languages which conceptualise/describe animals differently.

TOTAL SCORE

Add up the scores for each item to get a total score out of 30.

Any score of 22 or less should be considered as possible cognitive impairment and referred on for further investigation by the relevant physician.
Appendix H: Adapted Story Memory Recall Test Instructions

Administration
The Story Recall Memory Test (SRMT) examines the encoding, storage and retrieval processes of the memory system, as well as the meaning of words and sentences that affect the memory system. The objective of the SRMT is for participants to remember as much detail as possible with the greatest accuracy.

There is no time delay with the SRMT. Nor is there a specific recall time limit. Scoring for each story should cease when the participant cannot provide any more information. The two stories are delivered one at a time and during one session with the participant, ideally in a setting that has the least background noise and distraction. A repeat test should be carried out 1-5 days afterwards.

The stories must be delivered at a natural speed but in a clearly articulated and natural, conversational voice.

Instructions
This is an activity that measures memory.

I am going to tell you a short story.

You must listen carefully to the story because you need to remember it, and then say it back to me when I finish.

When you say it back to me, try to use the same words that I used if you can.

Try to tell me everything you can remember, even if you are not sure.

I will record your voice on a tape recorder so that I can remember what you said.

Are you ready? Any questions?

Story 1
Listen carefully to this story: The Hermannsburg / Sports Bus / carrying / the Hermannsburg Bulldogs / to Alice Springs / for football / blew a tyre / and went into the scrub. / No one / was hurt. / There was no spare tyre / and no tools / to fix /the
flat tyre. / After two hours / the Areyonga police / stopped to help. / The sports bus
/ got to town / at dinner time. / The Bulldogs / missed the grand final / and had to
forfeit / to Santa Teresa.

Now say that story back to me. *(Record Participant)*

Is that all of the story? Was there anything else?

*Instructions*

Now I will tell you another story.

Same as before, you need to listen carefully to the story because you need to
remember it and then say it back to me.

Try to use the same words that I used if you can.

Try to tell me everything you can remember, even if you are not sure.

*Story 2*

Listen carefully to this story: Charlie / from Yuendumu / works /as a ranger / in the
Council / and likes shooting / for kangaroo / when the sun goes down. / He told his
boss / that when he was shooting / on Sunday / he was chased / by wild dogs /and
tripped /and hurt / his leg. / Charlie was sore / for a long time after that / and could
not work / or go shooting / for one month.

Now say that story back to me. *(Record Participant)*

Is that all of the story? Was there anything else?
### Appendix I: Story Memory Recall Test Result Form

#### TEST 1: STORY

**DATE:**                        **PARTICIPANT NUMBER:**            **SCORER NAME:**

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Item</th>
<th>Score</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The Hermannsburg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Sports Bus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Carrying</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>The Hermannsburg Bulldogs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>To Alice Springs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>For football</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Blew a tyre</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>And went into the scrub</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>No one</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Was hurt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>There was no spare tyre</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>And no tools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>To fix</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>The flat tyre</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>After two hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>The Areyonga police</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Stopped to help</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>The sports bus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Got to town</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>At dinner time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>The Bulldogs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Missed the grand final</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>And had to forfeit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>To Santa Teresa</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Participant’s Response (Verbatim):**

The Hermannsburg / Sports Bus / carrying / the Hermannsburg Bulldogs / to Alice Springs / for football / blew a tyre / and went into the scrub. / No one / was hurt. / There was no spare tyre / and no tools / to fix / the flat tyre. / After two hours / the Areyonga police / stopped to help. / The sports bus / got to town / at dinner time. / The Bulldogs / missed the grand final / and had to forfeit / to Santa Teresa.

**STORY 1 TOTAL SCORE:**

---

106
TEST 1: STORY 2

Story 2

Charlie / from Yuendumu / works / as a ranger / in the Council / and likes shooting / for kangaroo / when the sun goes down. / He told his boss / that when he was shooting / on Sunday / he was chased / by wild dogs / and tripped / and hurt / his leg. / Charlie was sore / for a long time after that / and could not work / or go shooting / for one month.

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Item</th>
<th>Score</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Charlie</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>from Yuendumu</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Works</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>as a ranger</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>in the Council</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>and likes shooting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>for kangaroo</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>when the sun goes down</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>He told his boss</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>that when he was shooting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>on Sunday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>he was chased</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>by wild dogs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>and tripped</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>and hurt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>his leg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Charlie was sore</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>for a long time after that</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>and could not work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>or go shooting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>for one month</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

STORY 2 TOTAL SCORE:
Appendix J: Story Memory Recall Test Scoring Criteria

STORY 1

The Hermannsburg/ Sports Bus / carrying / the Hermannsburg Bulldogs / to Alice Springs / for football / blew a tyre / and went into the scrub. / No one / was hurt. / There was no spare tyre / and no tools / to fix /the flat tyre. / After two hours / the Areyonga police / stopped to help. / The sports bus / got to town / at dinner time. / The Bulldogs / missed the grand final / and had to forfeit / to Santa Teresa.

<table>
<thead>
<tr>
<th>Item</th>
<th>Scoring Principle</th>
<th>Example Correct Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Hermannsburg</td>
<td>Hermannsburg is required</td>
<td>Hermannsburg, Ntaria</td>
</tr>
<tr>
<td>Sports Bus</td>
<td>Bus is required</td>
<td>The Bus, a Bus, the Sports Bus, a Sports Bus, Football bus, Ntaria/Hermannsburg bus</td>
</tr>
<tr>
<td>carrying</td>
<td>any synonym of carrying</td>
<td>Carrying, carried, took, with, holding</td>
</tr>
<tr>
<td>the Hermannsburg Bulldogs</td>
<td>Bulldogs is required</td>
<td>Bulldogs</td>
</tr>
<tr>
<td>to Alice Springs</td>
<td>Alice Springs is required</td>
<td>Alice Springs, Town, To town</td>
</tr>
<tr>
<td>for football</td>
<td>football or synonym is required</td>
<td>Football, footy</td>
</tr>
<tr>
<td>blew a tyre</td>
<td>any synonym of blew a tyre</td>
<td>blew a tyre, got a flat tyre (in any context), got a puncture, had a blow out</td>
</tr>
<tr>
<td>and went into the scrub.</td>
<td>any indication of a crash or accident</td>
<td>Crash, accident, prang, went off the road, lost control</td>
</tr>
<tr>
<td>No one</td>
<td>any synonym of no one</td>
<td>no one, Nobody, Everyone/Everybody (was ok/fine)</td>
</tr>
<tr>
<td>was hurt</td>
<td>any synonym of hurt</td>
<td>Hurt, Injured, (Everyone/everybody) was ok/fine</td>
</tr>
<tr>
<td>There was no spare tyre</td>
<td>any synonym of no spare tyre</td>
<td>no spare, no spare tyre, no spare wheel</td>
</tr>
<tr>
<td>and no tools</td>
<td>any synonym of no tools</td>
<td>no parts, no tools, nothing (to fix the tyre with), no jack, no brace</td>
</tr>
<tr>
<td>to fix</td>
<td>any synonym of to fix</td>
<td>Repair, mend, sort out, make it work, get going, change</td>
</tr>
<tr>
<td>the flat tyre.</td>
<td>any synonym of flat tyre</td>
<td>flat tyre, busted tyre, flatty, broken wheel, no good wheel, the blow out</td>
</tr>
<tr>
<td>Event</td>
<td>Required</td>
<td>Notes</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-----------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>After two hours</td>
<td>two hours or a phrase meaning about two hours (e.g. couple of hours) is required</td>
<td>two hours, couple of hours, few hours, Long time, long time after that</td>
</tr>
<tr>
<td>the Areyonga police</td>
<td>Areyonga police or synonym is required</td>
<td>Areyonga police, Areyonga cops, Areyonga coppers, Utju (Areyonga alternative name), Utju police, Police officer, Policeman</td>
</tr>
<tr>
<td>stopped to help.</td>
<td>any indication that assistance was offered</td>
<td>Helped, assisted, rescued, pulled over, pull up, pulled up</td>
</tr>
<tr>
<td>The sports bus</td>
<td>Bus required</td>
<td>The Bus, a Bus, the Sports Bus, a Sports Bus, Football bus. Ntaria/Hermannsburg bus</td>
</tr>
<tr>
<td>got to town</td>
<td>any indication that the bus arrived to town or destination</td>
<td>got to town, got there, arrived, made it to town</td>
</tr>
<tr>
<td>at dinner time.</td>
<td>any indication that it was evening</td>
<td>dinner time, evening, night/night time, dark, suppertime, tea time</td>
</tr>
<tr>
<td>The Bulldogs</td>
<td>Bulldogs is required</td>
<td></td>
</tr>
<tr>
<td>missed the grand final</td>
<td>any indication that they did not arrive in time to play the game</td>
<td>missed the game/match/final, didn’t make it in time (to play) , missed out on playing, were too late</td>
</tr>
<tr>
<td>and had to forfeit</td>
<td>any indication that they were forced to forfeit the game</td>
<td>Forfeit, surrender, give up, lost (the match), forgo, never played</td>
</tr>
<tr>
<td>to Santa Teresa.</td>
<td>Santa Teresa is required</td>
<td>Lyente Apurte</td>
</tr>
</tbody>
</table>
Charlie / from Yuendumu / works /as a ranger / in the Council / and likes hunting / for kangaroo / when the sun goes down. / He told his boss / that he was chased / by wild dogs / when he was hunting / on Sunday. / Charlie tripped / and hurt / his leg. / Charlie was sore / for a long time / after that / and could not work / or go hunting / for one month.

<table>
<thead>
<tr>
<th>Item</th>
<th>Scoring Principle</th>
<th>Example correct answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlie</td>
<td>Charlie or variant of the name is required</td>
<td>Charlie, Charles, Kumanjayi</td>
</tr>
<tr>
<td>from Yuendumu</td>
<td>Yuendumu is required</td>
<td>Yuendumu, Yurrampi (pronounced Yurlumbi)</td>
</tr>
<tr>
<td>works</td>
<td>any indication that he is employed</td>
<td>Works, employed, his job, He works</td>
</tr>
<tr>
<td>as a ranger</td>
<td>ranger or synonym is required</td>
<td>ranger, park ranger, park caretaker, keeper</td>
</tr>
<tr>
<td>in the Council</td>
<td>council or synonym is required</td>
<td>Council, local area/municipality/authority/government, community council office, Yuendumu Town Council Office</td>
</tr>
<tr>
<td>and likes hunting</td>
<td>hunting or synonym is required</td>
<td>Hunting, shooting, catching, spearing</td>
</tr>
<tr>
<td>for kangaroo</td>
<td>kangaroo is required</td>
<td>Kangaroo, Marlu</td>
</tr>
<tr>
<td>when the sun goes down.</td>
<td>any indication that hunting occurs during evening</td>
<td>when the sun goes down, evening, sunset, dusk, night/nightfall, Sun down, Late, late evening, afternoon</td>
</tr>
<tr>
<td>He told his boss</td>
<td>any indication that his boss (or synonym e.g. manager) was told</td>
<td>told his boss, said to his boss, let his boss know, Talked to his boss</td>
</tr>
<tr>
<td>that he was chased</td>
<td>any indication that he was chased</td>
<td>Chased, followed, run after, pursued</td>
</tr>
<tr>
<td>by wild dogs</td>
<td>dogs or synonym is required</td>
<td>Dogs, wild dogs, pack, cheeky dog</td>
</tr>
<tr>
<td>when he was hunting</td>
<td>any indication that chasing occurred during hunting</td>
<td>when/while he was hunting/shooting</td>
</tr>
<tr>
<td>on Sunday.</td>
<td>Sunday is required</td>
<td>Sunday</td>
</tr>
<tr>
<td>Charlie tripped</td>
<td>any indication that he tripped</td>
<td>Tripped, fell over, fell down, fallen, fall over, fall down</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------------------</td>
<td>---------------------------------------------------------</td>
</tr>
<tr>
<td>and hurt</td>
<td>any indication that he was injured</td>
<td>Hurt, injured, got hurt</td>
</tr>
<tr>
<td>his leg.</td>
<td>leg or synonym is required</td>
<td>Leg, foot</td>
</tr>
<tr>
<td>Charlie was sore</td>
<td>any indication that he was in pain</td>
<td>Sore, in pain / a lot of pain, bruised, hurt, really sore</td>
</tr>
<tr>
<td>for a long time after that</td>
<td>any indication that the pain endured some time</td>
<td>long time, a while, some time, ages</td>
</tr>
<tr>
<td>and could not work</td>
<td>any indication that he was unable to work</td>
<td>could not (go to) work, could not do his job, out of action, can’t work, too sick, feeling too sick</td>
</tr>
<tr>
<td>or go hunting</td>
<td>any indication that he was unable to go hunting</td>
<td>go hunting, get food, get kangaroo, shooting</td>
</tr>
<tr>
<td>for one month.</td>
<td>one month, or a phrase meaning a few weeks (e.g. four weeks) is required</td>
<td>one month, a few weeks, four weeks, a long time , a long while</td>
</tr>
</tbody>
</table>
Appendix K: Participant Information Sheet

Optimum Thiamine Intervention (OpT In) Trial: Pilot Phase

Participant Information Sheet

This is for you to keep

What is the research about?

This is the pilot phase or test phase for a larger study that will happen later at this hospital (ASH). The researchers want to find out if the assessments and interview questions that will be used in the larger study are easy to understand and appropriate to use. They will ask a small group of people to test them out and tell the researchers what they think. The information gathered now will help make the tools and questions better for the people who will take part later.

The main study is trying to find out the best amount of medication to give patients with low levels of Vitamin B1 and how their eating habits and drinking (alcohol) might contribute to low Vitamin B1. If you would like to know more about this larger study please ask for an information sheet.

What will you be asked to do for this study?

If you decide to participate in this study we will now ask you to do three things:

Give consent for us to access and use your medical information in this study. We will look at your medical file to get information like whether you have any medical conditions that might affect your Vitamin B1 levels or your thinking. We will also collect information about any blood tests or other tests you might have had. We will write down your information using an identification number instead of your name
so that no one but us (the research team) will know whose information it is. This will help us to test out the form we will use to collect this information in the main study.

Do one of the following which will take about 10-20 minutes:

Do some thinking tests that will tell us how well your brain is doing different jobs, like memory, concentration, or problem solving.

After 1 day in hospital, we will ask you to repeat the test.

Answer some questions that includes general information about your life and your health, and also about your alcohol or drug use and your eating habits.

Look at the information sheet and consent form for the main study and tell us what you thought of them.

After doing one of these things above:

You will be asked if the process and tools are easy to understand or how they can be made better. We would like to audio or video record this part if you agree. This will take about 30 minutes.

* There are no right or wrong answers to the tests or questions. We want to know what you think, if there is anything you didn’t like about the tests or questions or any parts that were hard to understand and how you think they could be made better.

The care you receive from the hospital will not be affected in any way whether you decide to participate or not

You can say ‘no’ to all or part of the research and can withdraw at any time. What happens to your information?
Your information will be kept private and confidential at all times. Once collected, we will assign a number to your information (for use in the research) instead of using your name so that no one will know that it is your information except us. We will not tell anyone else your individual results or answers and all of your information will be stored in a locked filing cabinet or on a password protected computer. A copy of your results will be kept in your medical file. The results from all the patients in the study will be grouped together (without names) and a report prepared to show, as a whole group, how assessment tools and interviews can be made better and why.

Taking part in this study is voluntary. You can change your mind and stop taking part at any time without it affecting the care you receive from the hospital. If you change your mind, you can ask for the information already collected to be removed from the research at any time prior to preparation of the final report. If you change your mind about being in this study, please contact Dr Kylie Dingwall or Dr Jen Delima on the contact details below.

Thank you for helping us with this project.

If you have any questions about this study, please contact:

Dr Kylie Dingwall at Menzies School of Health Research. Phone: (08) 89514753.
Email: kylie.dingwall@menzies.edu.au or

Dr Jennifer Delima at Alice Springs Hospital. Phone: (08) 89517777.
Email: Jennifer.Delima@nt.gov.au

If you have any concerns or complaints about the conduct of the study, please contact either:

The Ethics Administration Officer, Central Australian Human Research Ethics Committee Ph: (08) 8951 4766 (Alice Springs) or
The Ethics Administration Officer, Human Research Ethics Committee of the NT Department of Health and Menzies School of Health Research. Ph: (08) 89227922 (Darwin).
Appendix L: Flip Chart

Optimum Thiamine Intervention Trial: Pilot Phase
What we are asking you to do
OpT In Trial: Pilot Phase

- **Test phase** for a larger study
- Are the **study materials** any good?
- **Test them out with you**
- **Ask you** what you think about them.
Do

Some MEMORY and THINKING GAMES

Repeat after 1 day
Then, tell us what you think of them.

We would like to audio record this part if you agree?
Let us access your MEDICAL FILES
To collect information such as:

- Medical conditions
- Blood tests
- Other medical tests
- Alcohol use

We will use a number instead of your name to protect your privacy.
We will write a Report of the results
Are the memory and thinking games any good?
We will not use your name
We will not tell anyone you were in this study.
Participation is voluntary
You can say ‘no’ at any time
You can ask as many questions as you like
If you are happy to help us with this study
Please sign the consent form
You are being asked to take part in the pilot phase of a larger study that will happen later at this hospital. You can help us test the tools that will be used and make them better for people in future.

Consent Form

This means that you can say “No”

<table>
<thead>
<tr>
<th>If you are happy to participate, we ask that you agree to the following:</th>
<th>(Circle yes or no)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Let your medical information, without your name on it, be used in the Menzies research (i.e. Menzies will access your medical file)</td>
<td>Yes</td>
</tr>
<tr>
<td>2. Do some activities, called a cognitive assessment to measure brain functions like memory, decision making and concentration.</td>
<td>Yes</td>
</tr>
<tr>
<td>3. Talk with the researcher to give feedback on the tools</td>
<td>Yes</td>
</tr>
<tr>
<td>4. Let the activities be audio recorded</td>
<td>Yes</td>
</tr>
</tbody>
</table>

By signing this form you agree that:

- You have read, or had read to you, the information sheet and understand the study and what you will be asked to do.
- You understand that you do not have to be in the study if you do not want to and can withdraw at any time without any impact on you or the care you receive.
- You understand that all the information given to Menzies will be kept private. Your name will not appear next to any private information. A number will be used instead.

Participant Name...........................................................................................................
Participant Signature ………………………………………………… Date…………………

Witness or Interpreter Name…………………………………………………………
Witness or Interpreter Signature………………………………………. Date …………………

Researcher declaration

I have described to..............................................................................(print name) the nature of the procedures to be carried out and provided an opportunity to ask questions. In my opinion she/he understood the explanation and freely consents to participation.

Researcher Name ………………………………………………………

Researcher Signature ………………………………………………..Date………………..
Appendix N: Qualitative Interview Scripts

CogState Interview Guide
Complete CogState with the participant.

*Time how long it takes to complete and write it down.*

*Observe for any misunderstandings, distractions, unusual responses etc and write them down and for which task they were.*

“Now I’m going to ask you how you felt when you were doing the test. We want to make sure that the rules of the test are easy to understand so please be honest and let us know if there is anything that is confusing or doesn’t make sense or if there is anything you don’t like about it.”

What did you think about doing this test? *Prompt:* hard, too easy, fun, too long, made you tired.

What did you like about doing this test?

What didn’t you like about doing this test?

“Were the instructions I gave easy or hard to understand?” *If hard,* “what was hard to understand?” *Prompt:* the way I spoke and explained it, English is hard, which one

“If you had to explain this test to someone, what would you say?” OR “Can you explain to me what you had to do in this test?” Go through each of the tasks one by one:

Has the card turned over? (Do you remember what you had to do in this test? Can you tell me?)

Is the card red? (Do you remember what you had to do in this test? Can you tell me?)
Have you seen the card before in this task? (Do you remember what you had to do in this test? Can you tell me?)

Is the previous card the same? (Do you remember what you had to do in this test? Can you tell me?)
“What did you think about doing it on the computer?”

“Now that you have done this test, how do you think other Aboriginal people in hospital would feel about doing the test?”

“Is there anything we could do to make it easier/better for people?” (*e.g. introduce it better, in language*)

Remind the participant that you will come back tomorrow and ask them to repeat the test.
CORSI Interview Guide
Complete CORSI with the participant.

Time how long it takes to complete and write it down

Observe for any misunderstandings, distractions, unusual responses etc and write them down.

“Now I’m going to ask you how you felt when you were doing the test. We want to make sure that the rules of the test are easy to understand so please be honest and let us know if there is anything that is confusing or doesn’t make sense or if there is anything you don’t like about it.”

“What did you think about doing this test?” hard, easy, fun, too long, made you tired.

What did you like about doing this test?

What didn’t you like about doing this test?

“Were the instructions easy to understand, or hard?” If hard, “what was hard to understand?” Prompt: the way I spoke and explained it, English is hard to understand.

“If you had to explain this test to someone, what would you say?” OR “Can you explain to me what you had to do in this test?”

“What did you think about using the computer?”

“Now that you have done this test, how do you think other Aboriginal people in hospital would feel about doing the test?”

“Is there anything we could do to make it easier/better for people?” (e.g. introduce it better)
Remind the participant that you will come back tomorrow and ask them to repeat the test.
**RUDAS Interview Guide**

Complete RUDAS with the participant.

Time how long it takes to complete and write it on the form.

Observe for any misunderstandings, distractions, unusual responses etc and write them down and for which question they were.

“Now I’m going to ask you how you felt when you were doing the test. We want to make sure that the instructions are easy to understand so please be honest and let us know if there is anything that is confusing or doesn’t make sense or if there is anything you don’t like about it.”

What did you think about doing this test? *Prompt: Fun, too hard, easy, frustrating*

What did you like about doing this test?

What didn’t you like about doing this test?

Were any questions hard to understand? Which ones? Why?

*(Prompt on each activity)*

The shopping list

Did my instructions make sense to you?

If you had to tell someone about this one, how would you explain it? Imagine I was the patient and you had to explain that question, what words would you use?

The body parts

Did my instructions make sense to you?

If you had to tell someone about this one, how would you explain it? Imagine I was the patient and you had to explain that question, what words would you use?

The hands activity (demonstrate)
Did my instructions make sense to you?

If you had to tell someone about this one, how would you explain it? Imagine I was the patient and you had to explain that question, what words would you use?

The drawing

Did my instructions make sense to you?

If you had to tell someone about this one, how would you explain it? Imagine I was the patient and you had to explain that question, what words would you use?

Crossing the Road

Did my instructions make sense to you?

If you had to tell someone about this one, how would you explain it? Imagine I was the patient and you had to explain that question, what words would you use?

The animals

Did my instructions make sense to you?

If you had to tell someone about this one, how would you explain it? Imagine I was the patient and you had to explain that question, what words would you use?

“Now that you have done this test, how do you think other Aboriginal people in hospital would feel about doing the test?”

“Is there anything we could do to make it easier/better for people?” (*e.g. introduce it better, in language*)

Remind the participant that you will come back tomorrow and ask them to repeat the test.
SMRT Interview Guide
Complete the two stories with the participant.

Record the participant

Time how long it takes to complete and write it down

Observe for any misunderstandings, distractions, unusual responses etc and write them down.

Record alternative words that the participant may use in place of the words in the story.

“Now I’m going to ask you how you felt when you were doing the memory activity. We want to make sure that the activity is easy to understand so please be honest and let us know if there is anything that is confusing or doesn’t make sense or if there is anything you don’t like about it.”

“What did you think about recalling this story?” hard, easy, fun, too long, made you tired.

“What did you like about doing this activity?”

“What didn’t you like about doing this activity?”

The question below is trying to gauge whether the stories are appropriate and culturally relevant.

“What do you think about the stories we used?”

“Are they any good for Aboriginal people?” Why?

If NO, “Why are they not good for Aboriginal people?”

“What kind of story would be better to use with Aboriginal people?”
“Were the instructions easy to understand, or hard?” If hard, “what was hard to understand?”

Prompt: the way I spoke and explained it, English is hard to understand.

“If you had to explain this test to someone, what would you say?” OR “Can you explain to me what you had to do in this test?”

“What did you think about remembering a story as a way to exercise your mind?”

“Is there anything we could do to make the activity easier/better for people?” (e.g introduce it better)

Remind the participant that you will come back tomorrow and ask them to repeat the test.
## Appendix O: International Classification of Disease Summary

### Primary Diagnosis Codes

<table>
<thead>
<tr>
<th>ICD-10 Chapter</th>
<th>ICD-10 Categories</th>
<th>Count of Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Certain infectious and parasitic diseases</td>
<td>A00-A09 Intestinal infectious diseases</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>B35-B49 Mycoses</td>
<td>1</td>
</tr>
<tr>
<td>II Neoplasms</td>
<td>C00-C97 Malignant neoplasms</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>D10-D36 Benign neoplasms</td>
<td>1</td>
</tr>
<tr>
<td>IV Endocrine, nutritional and metabolic diseases</td>
<td>E10-E14 Diabetes mellitus</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>E70-E90 Metabolic disorders</td>
<td>3</td>
</tr>
<tr>
<td>IX Diseases of the circulatory system</td>
<td>I00-I02 Acute rheumatic fever</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>I26-I28 Pulmonary heart disease and diseases of pulmonary circulation</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>I30-I52 Other forms of heart disease</td>
<td>5</td>
</tr>
<tr>
<td>X Diseases of the respiratory system</td>
<td>J09-J18 Influenza and pneumonia</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>J40-J47 Chronic lower respiratory diseases</td>
<td>1</td>
</tr>
<tr>
<td>XI Diseases of the digestive system</td>
<td>K55-K64 Other diseases of intestines</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>K80-K87 Disorders of gallbladder, biliary tract and pancreas</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>K90-K93 Other diseases of the digestive system</td>
<td>1</td>
</tr>
<tr>
<td>XII Diseases of the skin and subcutaneous tissue</td>
<td>L00-L08 Infections of the skin and subcutaneous tissue</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>L60-L75 Disorders of skin appendages</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>L80-L99 Other disorders of the skin and subcutaneous tissue</td>
<td>1</td>
</tr>
<tr>
<td>XIII Diseases of the musculoskeletal system and connective tissue</td>
<td>M00-M25 Arthropathies</td>
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## Secondary Diagnosis Codes

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<td>I Certain infectious and parasitic diseases</td>
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<td>B95-B98 Bacterial, viral and other infectious agents</td>
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<td>D60-D64 Aplastic and other anaemias</td>
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<td>D65-D69 Coagulation defects, purpura and other haemorrhagic conditions</td>
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