Normative Indicators for a Black, Xhosa Speaking Population without Tertiary Education on Four Tests Used to Assess Malingering

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COMPULSORY DECLARATION

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works of other people has been attributed, and has been cited and referenced.

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Abstract

Malingering has become an increasing concern in neuropsychological assessment in recent years, and a wide range of tests have been designed and examined for the purpose of detecting malingering. Cut-off scores have been recommended for these tests in order to provide indications of malingering performances. However, the derived scores have been in respect of westernised populations of people with relatively high levels of education who speak English as their first language. Accordingly, the current study aimed to attain normative data and cut-off scores for four commonly employed neuropsychological tools, administered in English, on a population of black, South African, Xhosa-speaking people (N = 33), who attended a former DET-type school in the Eastern Cape, with a Grade 11-12 level of education, in the age range of 18 - 40 years. The targeted measures included the TOMM, the Rey-15 Item Memory Test, the Digit Span subtest of the WAIS-III, and the Trail Making Test. The obtained scores were poorer than the previously published cut-offs for at least one component of each of the tests investigated, except the TOMM. The findings of this study highlight the important role that the factors of culture, quality of education, and language play in neuropsychological test performance.

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1. Introduction and Literature Review

1.1 Introduction

Neuropsychological assessment frequently involves the evaluation of the nature and extent of dysfunction related to traumatic head injury (Kelly, Binder, Villanueva & Winslow, 1995). The possibility of financial gains in certain cases provide the incentive to feign or exaggerate neuropsychological symptoms during psychological assessment, otherwise known as malingering (Kelly et al., 1995; Lee, Loring & Martin, 1992; Lezak, Howieson & Loring, 2004; Loring, 1995; Miller, 1996; Teichner & Wagner, 2004; Tombaugh, 1996). Such cases may include instances where an injury was sustained during a motor vehicle or occupational accident, or in military service, or where an opportunity exists for ill or seriously injured people to evade military service or to be excused of responsibility for crimes (Kelly et al., 1995; Lee et al., 1992; Lezak et al., 2004; Loring, 1995; Miller, 1996; Teichner & Wagner, 2004; Tombaugh, 1996.). Historically, neuropsychologists would use their clinical judgement and qualitative observations to assess for malingering (Tombaugh, 1997). This would consist of clinicians making note of indicators of suboptimal effort, such as inconsistent performances on multiple tests of the same cognitive function or obtaining lower scores on easier tasks than on more difficult ones (Tombaugh, 1997).

However, the validity of these qualitative indicators can be questionable, and they may commonly overlap with genuine symptoms (Miller, 1996; Tombaugh, 1997). Furthermore, in legal cases, in which neuropsychologists have become increasingly involved, empirical evidence is required as proof of malingering, in addition to clinical observations (Arnett, Hammeke & Schwartz, 1995; Miller, 1996). Subsequently, it has been suggested that measures designed specifically to detect malingering be developed and included in all neuropsychological assessments, and an expansive amount of research has been conducted to develop and investigate the efficacy of such measures (Arnett et al., 1995; Fisher & Rose, 2005; Greiffenstein, Baker & Gola, 1994; Greve et al., 2006; Iverson, Le Page, Koehler, Shojania & Badii, 2007; Kelly et al., 1995; Lee et al., 1992; Lezak et al., 2004; O'Bryant, Engel, Kleiner, Vasterling & Black, 2007; Rees, Tombaugh & Boulay, 2001; Rees, Tombaugh, Gansler & Moczynski, 1998; Rosenfeld, Sands & Van Gorp, 2000; Teichner & Wagner, 2004; Tombaugh, 1996, 1997; Yanez, Fremouw, Tennant, Strunk & Coker, 2006). Additionally, research has been conducted on utilising standard neuropsychological tests generally included in most test batteries for the purpose of detecting feigned or exaggerated effort (Axelrod,

Fichtenberg, Millis & Wertheimer, 2006; Babikian, Boone, Lu & Arnold, 2006; Egeland & Langfjaeran, 2007; Greiffenstein et al., 1994; Inman & Berry, 2002; Iverson, Lange, Green & Franzen, 2002; Iverson & Tulsky, 2003; Larrabee, 2003; Lezak et al., 2004; O'Bryant, Hilsabeck, Fisher & McCaffrey, 2003; Ruffolo, Guilmette & Willis, 2000; Tombaugh, 1996). This introductory section will firstly briefly examine the existing literature on some of the tests in both of these categories which are commonly used to detect malingering. It will then explore the effect that culture, language, and quality of education have on neuropsychological test performance, thus emphasising the need for normative data to be produced on all cognitive tests, including those used to assess malingering, in South Africa.

1.2 Tests Specifically Designed to Assess Malingering

Poor memory is frequently the initial symptom seen in patients presenting with organic brain damage and is subsequently the most commonly reported symptom in malingering patients (Lezak et al., 2004; Tombaugh, 1996). Consequently, measures of malingering are generally tests of memory impairment (Arnett et al., 1995; Lezak et al., 2004; Rees et al., 1998; Tombaugh, 1996, 1997). Amongst the most common of these are symptom validity tests, which are forced-choice tests designed to be relatively easy for all people, except perhaps for those who have significant neurological impairment, and other simple tests of memory that patients are made to believe are very difficult (Lee et al., 1992; O'Bryant et al., 2007; Rees et al., 1998; Tombaugh, 1996, 1997). Amongst the most frequently used of these tests are the Test of Memory Malingering (TOMM) (O'Bryant et al., 2007; Tombaugh, 1996) and the Rey 15-Item Memory Test (Arnett et al., 1995; Lezak et al., 2004; Rey, 1964). The most recent literature on these two respective tests will be discussed separately below.

1.2.1 The Test of Memory Malingering (TOMM)

The TOMM is a 50-item test of recognition memory consisting of two learning trials and an additional optional retention task (O'Bryant et al., 2007; Rees et al., 1998, 2001; Teichner & Wagner, 2004; Tombaugh, 1996, 1997; Yanez et al., 2006). As Tombaugh (1996) reports, a person can correctly identify 50% of the items on this test (25/50 items) by guessing. Furthermore, by applying the binomial distribution, Tombaugh (1996) calculated that scores falling below 18/50 on the TOMM were highly unlikely to occur by chance. However, the results of several studies conducted on the TOMM as a part of the initial validation

process indicated that very few people obtain scores that fall below chance levels (Rees et al., 1998; Tombaugh, 1996, 1997). In contrast, the researchers found that in all of these studies, a wide range of participants (including those with genuine cognitive impairment and suspected and simulated malingerers) obtained extremely high scores on this test (Rees et al., 1998; Tombaugh, 1996, 1997). For instance, a group of cognitively intact adults obtained a mean score of 49.90 on both trial 2 and the retention trial of the TOMM, exceeding their own performance expectations (Tombaugh, 1996, 1997). Similar results were obtained in a study comparing cognitively intact individuals with patients with cognitive impairment, aphasia, traumatic brain injuries (TBIs) and dementia, with even the demented group scoring a mean of 45.7 (92% accuracy) on trial 2 and the retention trial (Tombaugh, 1996, 1997).

Subsequently from these studies, a criterion score of 45/50 was established, and this score correctly classified 95% of all non-demented participants and 91% of all participants as not malingering (Tombaugh, 1996, 1997). This criterion score also yielded high levels of sensitivity (that is, the percentage of people malingering that are correctly classified as such) and specificity (that is, the percentage of people not malingering correctly classified as such) when applied to a wide range of different participants. These included university students, TBI patients, patients suffering from varying types of cognitive impairment, simulated malingers and suspected malingerers (Rees et al., 1998; Tombaugh, 1996, 1997). These sources similarly found high levels of sensitivity and specificity for the TOMM when using varying administration procedures (using the standard pencil-and-paper version of the test, using a computerised version of the test, administering the test alone and administering the test in a battery of other neuropsychological tests) in separate validation studies conducted by Tombaugh and colleagues (Rees et al., 1998; Tombaugh, 1996, 1997).

This cut-off score was further validated in a study on 26 patients suffering from moderate to severe levels of depression (mean BDI score of 27.9) (Rees et al., 2001). In this study, Rees et al. (2001) found that all patients obtained a score of 49 or 50 on both Trial 2 and the retention trial of the TOMM. The application of the established cut-off score further yielded no misclassifications of malingerers, even in the severely depressed patients (BDI scores ranging from 30-51) included in the sample (Rees et al., 2001). In another study investigating the performances of depressed patients on the TOMM, Yanez et al. (2006) compared test results of patients with severe Major Depressive Disorder (N = 20; mean BDI-II score of 43.20) to those of non-depressed participants (N = 20). The researchers found that their depressed sample, like the participants in the study by Rees et al. (2001) obtained high results, with both participant groups obtaining mean scores

above 45. However, the researchers note that many of their participants were on anti-depressant medications at the time of testing and it is unclear what effect this factor may have had on test performance (Yanez et al., 2006). Similarly, 54 patients diagnosed with fibromyalgia, who were also experiencing high levels of self-reported depression, chronic pain and disability, obtained a mean score of 49.8 on trial 2 and 49.6 on the retention trial of the TOMM, thus giving further evidence for the utility of the TOMM and of the cut-off score of 45 on a wide range of people (Iverson et al., 2007).

This cut-off score was further shown to be useful in accurately identifying malingering and non-malingering participants in a study comparing performances on the TOMM of two groups of people who were at risk of sustaining cognitive impairment from toxic exposure (suspected malingerers (N = 33) and non-malingerers (N = 17)) with 14 TBI patients and 22 patients with diagnosed memory disorders (Greve et al., 2006). The application of the cut-off score of < 45 to this sample yielded perfect specificity and high levels of sensitivity (>50%). It appears that only one study has indicated a possible misclassification of participants as malingering when using a cut-off score of 45 and this was with a group of elderly patients (mean age of 70.5) with dementia (Teichner & Wagner, 2004). These results are in contrast to the findings of Tombaugh (1996, 1997) in his original validation studies, which indicated that even the dementia patients in the sample obtained scores above 45/50 on trial 2 and the retention trial of the TOMM. Teichner and Wagner (2004) suggest that the differences in findings between their study and those of Tombaugh (1996, 1997) may be attributable to their dementia group being more severely cognitively impaired than that used in the studies conducted by Tombaugh (1996, 1997). Nevertheless, even in the study by Teichner and Wagner (2004) study of 78 elderly patients, 100% of the cognitively intact participants and 92.7% of the non-demented, cognitively impaired patients obtained scores above 45. The authors therefore suggest that this cut-off score is still useful for detecting malingering in patients where dementia has been excluded (Teichner & Wagner, 2004).

Overall, these studies have indicated that non-demented participants ranging from normal controls to head-injured patients all generally perform at a very high level on the TOMM. Furthermore, the established cut-off of 45 on Trial 2 or the retention trial appears to accurately detect malingering in individuals without dementia. A summary of the findings from all of the studies investigating the TOMM that have been reviewed here is presented in Table 1.

Table 1

Summary Table of Findings from Reviewed Studies on the TOMM

Authors	Sample	N	Age (in years)		Education (in years)		Trial 2		Retention		Sensitivity (%)	Specificity (%)	Cut-off *
			M	SD	M	SD	M	SD	M	SD			
**Tombaugh (1996, 1997) & Rees et al. (1998)	Cognitively intact adults, simulated malingerers, litigating and non-litigating TBI patients, hospital outpatients, cognitively impaired adults, patients with dementia	-	20.4 – 72.1	-	11.8 – 14.1	-	>45	-	>45	-	82 – 100	91 - 100	< 45
Rees et al. (2001)	Depressed clinical group	26	40.4	11.2	14.9	2.8	49.9	0.2	49.9	0.3	-	-	< 45
	Non-litigating TBI group	24	40	14	13.6	2.7	49.6	1.3	49.6	1	-	-	< 45
	Community control group	26	42.3	10.3	12.7	1.2	49.9	0.4	49.9	0.5	-	-	< 45
Yanez et al. (2006)	Depressed clinical group	20	39.05	8.88	11.15	1.57	48	4.9	48.6	4.2	-	-	< 45
	Non-depressed control group	20	41.65	10.79	13.3	2.79	49.8	0.9	49.8	0.6	-	-	< 45
Iverson et al. (2007)	Patients with fibromyalgia	54	51.4	12.8	13.5	2.4	49.8	0.5	49.6	0.9	-	-	< 45
Greve et al. (2006)	Toxic exposure group suspected of malingering	33	43	11.4	10.8	2.9	40.9	10.3	38.5	11.8	+/- 60	-	< 45
	Non-malingering toxic exposure group	17	41.5	12.5	12.8	2.8	50	0	49.8	0.6	-	100	< 45
	Non-litigating TBI group	14	34.3	12.6	13.6	3.3	49.4	1	49.6	0.8	-	100	< 45
	Memory disorder patient group	22	73.5	9.3	12.5	3.3	46.9	5.5	46.0	6.4	-	100	< 45
Teichner & Wagner (2004)	Elderly dementia patient group	21	75.3	6.1	13.6	3.3	39.5	6.8	39.5	6.8	-	76.9[a]	< 45
	Elderly cognitively impaired patient group	36	70.6	8.1	14.2	3.2	48.6	2.8	48.3	2.9	-	94.7[b]	< 45
	Elderly normal control group	21	65.6	8.6	14.2	3.6	49.7	0.7	49.7	0.7	-	94.7[b]	< 45

*Cut-off scores are for trial 2 and retention trial.

** These are validation studies conducted by Tombaugh and his colleagues, including a number of different experiments, which utilise varying participant groups and administrations procedures.

[a]Specificity rate using cut-off of < 45 if dementia cannot be ruled out. [b]Specificity rate using cut-off of < 45 when dementia can be ruled out.

1.2.2 The Rey 15-Item Memory Test

The Rey 15-Item Memory Test is a simple task that is presented as being a very difficult test of memory functioning (Arnett et al., 1995; Lee et al., 1992; Lezak et al., 2004). Many studies have been conducted in an attempt to attain an appropriate cut-off score for malingering for this test (Arnett et al., 1995; Greiffenstein et al., 1994; Inman & Berry, 2002; Lee et al., 1992; Lezak et al., 2004). A number of varying cut-off scores have been indicated, with the most consistent being that of 9 correctly reproduced items in total, regardless of spatial location (Arnett et al., 1995; Greiffenstein et al., 1994; Inman & Berry, 2002; Lee et al., 1992; O'Bryant et al., 2003).

In their study comparing the performances of TBI patients (N = 30), patients with persistent postconcussive syndrome (PPCS) (N = 30) and probable malingerers (N = 43) on a number of commonly used measures of episodic memory and malingering, Greiffenstein et al. (1994) found that the probable malingering group performed significantly more poorly than both the TBI and PPCS groups on the Rey 15-Item Test. They further found that using a cut-off score of 9 items correct in any location, they attained sensitivity rates of 62-63% and specificity rates of 88-93%. Alternatively, when they used a cut-off score of 10, they attained sensitivity and specificity rates of 62-93% and 64-81% respectively. The authors note that the Rey 15-Item Test yielded the smallest overall hit rate (overall hit rate of 71% using a cut-off score of 10) of all the tests examined. However, they describe this as still being a respectable hit rate (Greiffenstein et al., 1994). Using the cut-off score of 9 items correct in any location, in their study cross-validating numerous measures of malingering on 55 university students who had previously suffered a head injury (randomly assigned to a simulated malingering or non-malingering group) and 53 participants with no history of prior head injuries (randomly assigned to a normal control group or simulated malingering group), Inman and Berry (2002) found that participants in the malingering groups scored significantly lower than those in the groups required to use optimal effort. They obtained an overall hit rate of only 53% (specificity rate of 100% and sensitivity rate of 2%) on the Rey 15-Item Test, a much lower overall hit rate than that obtained by Greiffenstein et al. (1994) using a cut-off score of 10 items correct in any position.

On the other hand, in their study investigating test performances on the Rey 15-Item Test in temporal lobe epilepsy patients with memory impairment compared to a group of outpatients with varying neurological conditions, Lee et al. (1992) found that at least 95% of all patients obtained scores of 8 or more. They proposed a cut-off score of < 7 correct items in any location, as this score was at or below the 5th percentile

of both participant group scores (Lee et al., 1992). This cut-off score is lower than those suggested by both Greiffenstein et al. (1994) and Inman and Berry (2002). Arnett et al. (1995) utilised a different cut-off score of < 8 in their two studies comparing the performance of neurologically impaired subjects with participants simulating malingering. They found that sensitivity rates were high, but specificity rates were only 74%-84% using this cut-off score. Alternatively, using the cut-off criterion of less than 2 rows correct, in correct spatial location, they found sensitivity rates of 47% and 64% and specificity rates of 97% and 96% in their two respective studies. They therefore suggest that using the criterion of < 2 rows correct in correct position is a more effective way of discriminating malingerers from non-malingerers than looking at the number of correct items in any spatial location (Arnett et al., 1995).

Overall, these studies have indicated that the measure of correct items in any position on the Rey 15-Item Test has yielded variable results, with cut-offs ranging from 7 to 10. On the other hand, the measure of correct rows in correct position has only been investigated in one study reviewed here (Arnett et al., 1995), and the cut-off indication was 2. A summary of the findings from all of the studies investigating the Rey 15-Item Memory Test that have been reviewed here is presented in Table 2.

1.3 Standard Neuropsychological Tests Commonly Used to Assess Malingering

In addition to tests designed specifically to assess for malingering, tests commonly included in standard neuropsychological batteries are also frequently used as measures of malingering (Axelrod et al., 2006; Babikian et al., 2006; Egeland & Langfjaeran, 2007; Fisher & Rose, 2005; Greiffenstein et al., 1994; Inman & Berry, 2002; Iverson et al., 2002; Larrabee, 2003; Lezak et al., 2004; Miller, 1996; O'Bryant et al., 2003). There are advantages to using standard cognitive tests as measures of malingering, such as the relatively easier accessibility and availability of these tests compared to those specifically designed to assess malingering, as well as the reduction of administration time when using a test already in a standard battery (Babikian et al., 2006; Lezak et al., 2004). Furthermore, using standard neuropsychological tests also makes it more difficult for advocates or interested others to coach patients to avoid detection via specific tests of malingering (Babikian et al., 2006; Lezak et al., 2004). Two of the standard cognitive tasks that are commonly used as indicators of malingering are the Digit Span subtest of the Wechsler Adult Intelligence Scale-Revised (WAIS-R) or the Wechsler Adult Intelligence Scale-Third Edition (WAIS-III) and the Trail Making Test. Some of the available literature investigating the utility of these two respective tests as

Table 2

Summary Table of Findings from Reviewed Studies on the Rey 15-Item Memory Test

Authors	Sample	N	Age (in years)		Education (in years)		Correct items (any location)		Correct rows (correct location)		Sensitivity (%)	Specificity (%)	Hit rate (%)	Cut-off	
			M	SD	M	SD	M	SD	M	SD				Correct items	Correct rows
Greiffenstein et al. (1994)	TBI group	33	33.1	9.5	11.3	1	12.8	2.8	-	-	-	88/81[a]	71[a]	< 9/ 10[c]	-
	PPCS* group	30	37.6	13.9	11.7	0.8	13.2	2.1	-	-	-	93/64[b]	-	< 9/10[c]	-
	Probable malingerer group	43	39.3	10	11.1	2.2	9.7	3.8	-	-	62/62[a] 63/93[b]	-	71[a]	< 9/10[c]	-
Inman & Berry (2002)	Head injured simulated malingerers	21	18.67	0.91	12.48	0.98	14	2.39	-	-	2	-	53	< 9[d]	-
	Head injured controls	24	18.67	1.69	12.25	0.61	14.83	0.65	-	-	-	100	53	< 9[d]	-
	Normal simulated malingerers	23	18.91	1.27	12.83	1.19	13.70	1.82	-	-	2	-	53	< 9[d]	-
	Normal controls	24	18.42	0.88	12.21	0.51	15	0	-	-	-	100	53	< 9[d]	-
Lee et al. (1992)	Temporal lobe epilepsy patients	100	30	9.6	11	2	12.5	2.8	-	-	-	-	-	< 7[e]	-
	Non-litigating outpatients	40	38.4	16	11.3	2.3	12.1	2.5	-	-	-	-	-	< 7[e]	-
	Litigating outpatients	16	35.4	9.8	9.8	2.4	9.1	3.8	-	-	-	-	-	< 7[e]	-
Arnett et al. (1995)	Study 1 Simulated malingerers	49	20.6	-	14.67	-	12.14	2.57	1.94	1.6	47	-	-	-	< 2
	Neurological Patients	34	39.6	-	13.03	-	12.77	2.34	3.32	1.12	-	97	-	-	< 2
	Study 2 Simulated malingerers	25	26.1	-	17.2	-	10.84	3.57	1.52	1.5	64	-	-	-	< 2
	Neurological Patients	25	38.9	-	12.8	-	12	2.29	3.28	1.10	-	96	-	-	< 2

* Persistent postconcussive syndrome. [a]Rates based on comparison between TBI and probable malingerer groups. Where 2 numbers given, the first number is based on a cut-off score of < 9 items correct in any location and the second score is based on a cut-off score of <10 items correct in any location. [b]Rates based on comparison between PPCS and probable malingerer groups. Where 2 numbers given, the first number is based on a cut-off score of < 9 items correct in any location and the second score is based on a cut-off score of < 10 correct in any location. [c]The first cut-off score was set at -1.3SD of the TBI group mean and the second cut-off score was set at -1.0SD of the TBI group mean. [d]Cut-off score chosen as it is the one most consistently used by other researchers. [e]5th percentile score used as cut-off.

measures of malingering will briefly be discussed below (Babikian et al., 2006; Inman & Berry, 2002; Iverson & Tulsky, 2003; O'Bryant et al., 2003; Ruffolo et al., 2000).

1.3.1 The Digit Span Subtest of the WAIS-R and the WAIS-III

Several different scores obtainable from the WAIS-R and WAIS-III Digit Span subtest have been used and investigated as means of identifying suspected malingerers, most notably the standard Age Correlated Scaled Score (ACSS) and the Reliable Digit Span (RDS) (Axelrod et al., 2006; Babikian et al., 2006; Greiffenstein et al., 1994; Inman & Berry, 2002; Iverson & Tulsky, 2003; Larrabee, 2003). The RDS is thesum of the longest correct strings of digits obtained on two trials on both the forwards and backwards tasks (Axelrod et al., 2006; Babikian et al., 2006; Inman & Berry, 2002; Iverson & Tulsky, 2003; Larrabee, 2003). Findings have been variable in terms of identifying an appropriate cut-off score (Axelrod et al., 2006; Babikian et al., 2006; Inman & Berry, 2002; Iverson & Tulsky, 2003; Larrabee, 2003).

In their study introducing the measure of the RDS, Greiffenstein et al. (1994) found that using a RDS cut-off score of 7 from the WAIS-R Digit Span subtest yielded sensitivity rates of 68-70% and specificity rates of 73-89% when comparing groups of probable malingerers, patients with persistent postconcussive syndrome, and TBI patients. On the other hand, using a RDS < 8 yielded higher sensitivity rates of 82%, but lower specificity rates of only 54-69% (Greiffenstein et al., 1994). Using this same cut-off score of RDS < 8 on the Digit Span subtest of the WAIS-R, Larrabee (2003) obtained a sensitivity rate of 50% and a specificity rate of 93.5% in his study investigating cut-off scores for five standard neuropsychological tests used to detect malingering on a group of 26 malingering participants and 31 patients suffering from moderate to severe closed head injuries. Additionally, Inman & Berry (2002) applied this same cut-off in their study cross-validating a number of different measures of malingering, obtaining a perfect (100%) specificity rate, but a low sensitivity rate of only 27%, giving an overall hit rate of 65% (Inman & Berry, 2002).

Alternatively, Iverson & Tulsky (2003) investigated test performance patterns of the digit span subtest of the WAIS-III using the ACSS measurement. Utilising the WAIS-III standardisation sample and several of the clinical groups presented in the WAIS-III technical manual, they suggested a cut-off score of ACSS < 5 or ACSS < 4 (Iverson & Tulsky, 2003). The ACSS cut-off score < 4 yielded high specificity rates, but only moderate sensitivity rates (Iverson & Tulsky, 2003). Babikian et al. (2006) conducted a study in which they compared ACSS and RDS scores of suspected malingering, neuropsychology outpatient, and normal control groups on either the WAIS-III or the WAIS-R Digit Span subtest. Consistent with the findings of Iverson &

Tulsky (2003), the results of the study by Babikian et al. (2006) indicate that an ACSS score of 5 or less is a relatively sensitive cut-off score (Babikian et al., 2006). Babikian et al. (2006) additionally found that a RDS score of 6 or less was more sensitive to accurately detect malingering than the cut-off scores of 7 or 8 suggested in the studies mentioned above (Babikian et al., 2006).

However, in their study comparing the ACSS and RDS scores from the WAIS-III digit span test on a group of probable malingerers and two TBI patient groups, Axelrod et al. (2006) found that ACSS was the best measure of malingering (Axelrod et al., 2006). They recommended a cut-off score of ≤ 7, which is higher than the ACSS cut-off suggested by Iverson & Tulsky (2003) and Babikian et al. (2006). Using this cut-off score of ACSS ≤ 7 produced a sensitivity rate of 75% and specificity rates of 69-77% (Axelrod et al., 2006). Overall, Axelrod et al. (2006) suggest that the digit span subtest should not be used as the only measure for the assessment of malingering, and recommend that it be used in combination with other indicators of malingering.

Overall, these studies have indicated that the measures of RDS and ACSS are those most commonly used to assess malingering from the Digit Span subtest of the WAIS-R/WAIS-III. Findings have varied substantially between studies, with cut-off scores ranging from 6-8 for the RDS and 4-7 for the ACSS. A summary of the findings of the studies investigating the ACSS and RDS measures from the Digit Span subtest of the WAIS-R/WAIS-III that have been reviewed here is presented in Table 3.

1.3.2 The Trail Making Test

Another commonly administered test that has also recently been examined for its efficacy as a measure of malingering is the Trail Making Test (Egeland & Langfjaeran, 2007; Iverson et al., 2002; O'Bryant et al., 2003; Ruffolo et al., 2000). A number of different measures of the Trail Making Test have been evaluated as being possible indicators of malingering, including: total time taken to complete Trail A and Trail B, number of errors made on Trail A and Trail B, and the ratio of the completion time on Trail B to the completion time on Trail A (TMTB: TMTA) (Egeland & Langfjaeran, 2007; Iverson et al., 2002; O'Bryant et al., 2003; Ruffolo et al., 2000). Varying results have been found using these different measures.

Table 3

Summary Table of Findings from the Digit Span Subtest of the WAIS-R/WAIS-III

Authors	Sample	N	Age (in years)		Education (in years)		RDS		ACSS		Sensit-ivity (%)	Specif-icity (%)	Cut-off	
			M	SD	M	SD	M	SD	M	SD			RDS	ACSS
Greiffenstein et al. (1994)	TBI group	33	33.1	9.5	11.3	1	8.8	1.2	-	-	-[a]	73/54[a]	< 7/8[c]	-
	PPCS group	30	37.6	13.9	11.7	0.8	8.9	1.1	-	-	-	89/69[b]	< 7/8[c]	-
	Probable malingerer group	43	39.3	10	11.1	2.2	6.7	1.2	-	-	70/82[a] 68/82[b]	-	< 7/8[c]	-
Larrabee (2003)	Definite malingerer group	26	39.33	11.78	12.54	2.25	-[5]	-	-	-	50	-	< 8[d]	-
	Moderate-severe closed head injury group	31	34.80	16.78	12.56	2.56	-[5]	-	-	-	-	93.5	< 8[d]	-
Inman & Berry (2002)	Head injured simulated malingerers	21	18.67	0.91	12.48	0.98	9.19	2.27	-	-	27	-	< 8[e]	-
	Head injured controls	24	18.67	1.69	12.25	0.61	11.58	2.39	-	-	-	100	< 8[e]	-
	Normal simulated malingerers	23	18.91	1.27	12.83	1.19	8.09	2.41	-	-	27	-	< 8[e]	-
	Normal controls	24	18.42	0.88	12.21	0.51	10.83	2.16	-	-	-	100	< 8[e]	-
Iverson & Tulsky (2003)	Mixed clinical sample	123	55	17.7	-	-	-	-	10.1	2.8	-	-	-	< 4/5[f]
	Matched controls	105	54	18.5	-	-	-	-	10.6	3.1	-	-	-	< 4/5[f]
Babikian et al. (2006)	Suspected malingerer group	66	42.5	12.3	13	2.4	6.7	2.4	6.2	3.1	45/42[a]		≤ 6[h]	≤ 5[h]
	Clinical patient group	56	48.4	16.4	13.3	2.4	8.9	2	8.8	2.8	-	93/93[g]	≤ 6[h]	≤ 5[h]
	Normal control group	32	72.5	4.8	14.2	2.1	9.28	1.61	9.42	2.20	-	93/93[g]	≤ 6[h]	≤ 5[h]
Axelrod et al. (2006)	Non-malingering TBI group	29	38.2	17.8	12.8	2.1	8.6	1.8	8.5	2.1	-	69[i]	-	≤ 7[j]
	Probable malingering group	36	43.1	11.9	12.5	1.6	6.9	2.2	6.3	2.1	75[3]	-	-	≤ 7[j]
	Non-litigating mild TBI group	22	43.2	16.4	13.1	2.6	9.5	2.1	9.7	2.7	-	77[i]	-	≤ 7[j]

Note: PPCS = Persistent postconcussive syndrome; RDS = Reliable Digit Span; ACSS = Age Correlated Scaled Scores

[a]Rates calculated from comparison between TBI and probable malingerer groups. The first number is based on a cut-off score of RDS < 7 and the second score is based on a cut-off score of RDS < 8. [b]Rates calculated from comparison between PPCS and probable malingerer groups. The first number is based on a cut-off score of RDS < 7 and the second score is based on a cut-off score of RDS < 8. [c]The first cut-off score was set at -1.3SD of the TBI group mean and the second cut-off score was set at -1.0SD of the TBI group mean. [d]Cut-off score devised using a formula derived from comparisons between the 2 participant groups. [e]Cut-off score suggested by previous researchers. [f]Cut-off score suggested from base rate data for ACSS from standardisation sample & other clinical samples in WAIS-III manual. [g]The first sensitivity and specificity rates given based on a cut-off score of RDS ≤ 6 and the second rates given based on cut-off score of ACSS ≤ 5. [h]Cut-offs were suggested as they yielded the most acceptable sensitivity and specificity rates altogether. [i]Based on a cut-off score of ACSS ≤ 7. [j]Cut-off score suggested as it was found to be the best discriminating index and score.

For instance, in their study comparing error rates, Trail B:A ratios and completion times for both Trails A and B on a sample of head injured patients, suspected malingerers, simulated malingerers, and normal controls, Ruffolo et al. (2000) found that the two malingerer groups performed slower and obtained much higher error rates on both Trails A and B than all of the other participant groups. From the results of this study, Ruffolo et al. (2000) suggest that completion times and error scores on both Trails A and B of the

Trail Making test are the best indicators of malingering. They were unable to establish a cut-off score for completion times for both Trails A and B, as there was significant variability within the head-injured participant groups for these scores (Ruffolo et al., 2000). However, they recommend that a cut-off error score of 4 or more errors on either Trail A or B be used as a possible indicator of malingering (Ruffolo et al., 2000).

Iverson et al. (2002) conducted a similar study whereby they investigated completion times on Trails A and B and Trail B:A ratios for a group of 571 head injured participants. The researchers then utilised scores that were at or below the 5^{th} percentile as cut-off scores. They subsequently proposed the following cut-off scores: completion time for Trail A of $\geq$ 63 seconds, completion time for Trail B of $\geq$ 200 seconds, and Trail B:A ratio of $\leq$ 1.49. Applying these cut-off scores to a sample group of 228 litigating head injured patients, these researchers found that the Trail B:A ratio score yielded very low sensitivity rates of 2.4-7.4% and they concluded that this measure is of little value as an indicator of malingering (Iverson et al., 2002). On the other hand, their results suggested that completion times for Trials A and B were both more accurate indicators of malingering, showing similar findings to those of Ruffolo et al. (2000). However, these measures still yielded very low sensitivity rates of only 7.1-18.5% for all participant groups (Iverson et al., 2002). These researchers therefore concluded that, overall, the Trail Making Test is limited in its value as a measure of malingering (Iverson et al., 2002). O'Bryant et al. (2003) examined error rates and Trail B: A ratio scores in a group of suspected malingering and non-malingering TBI litigating patients (total N = 94). Their findings indicated that the suspected malingerers and non-malingerers did not differ significantly in Trail Making Test error scores, while the suspected malingering group obtained significantly lower Trail B:A ratio scores than the non-malingering group (O'Bryant et al., 2003). Nonetheless, consistent with the findings by Iverson et al. (2002) and Ruffolo et al. (2000), they found that Trail B:A ratio scores still yielded low sensitivity and specificity rates (63% and 45% respectively). Similarly, Egeland and Langfjaeran (2007) obtained a fairly low sensitivity rate of 61% and specificity rate of 57% using the cut-off score of Trail B:A ratio $\leq$ 2.5 in their study comparing a group of possible malingering, cognitively impaired and cognitively normal litigants.

Overall, these studies have indicated that clinicians should exercise caution when using the Trail Making test as an indicator of malingering, particularly when using the Trail B: A ratio score. Cut-off scores of ≥ 4 errors on either Trail, ≥ 63 seconds completion time on Trail A, ≥ 200 seconds completion time on Trail B and Trail B:A ratio scores of ≤ 1.49 and ≤ 2.5, have been suggested. A summary of the demographic information and results from the studies investigating the Trail Making Test that have been reviewed here is presented in Table 4. A summary of the suggested cut-off scores and the corresponding sensitivity and specificity rates from the studies reviewed is presented in Table 5.

1.4 Overall Findings on the Four Tests Used to Assess Malingering Reviewed

The majority of the studies reviewed above made comparisons in terms of the factors of age, gender and/or education between the varying participant groups that they utilised. However, the only studies to investigate whether any of these factors have an impact on neuropsychological test performance in a focussed way are those conducted by Tombaugh (1996, 1997). In these studies validating the TOMM, Tombaugh (1996, 1997) found that age and education did not have any significant effects on test performance on any of the trials of this test. All the other studies reviewed did not specifically investigate the role that these factors may have played on test results.

Overall, the studies described above have shown variable results in the validity of the TOMM, the Rey 15-Item Test, the Digit Span subtest of the WAIS-R/WAIS-III, and the Trail Making Test as measures to detect malingering. However, in the case of each test, it was suggested that the use of malingering indicators on that test, taken alongside clinical observations, should be able to at least provide some suggestion of suspected malingering.

1.5 The Effect of Culture, Language and Quality of Education on Neuropsychological Test Performance

The normative data and proposed cut-off scores for the tests reviewed above been obtained from studies conducted in westernised countries such as the United States of America, Canada, or England, using samples consisting of predominantly white participants, usually with English as their first language,

Table 4

Summary Table of Demographic Information and Results from Reviewed Studies on the Trail Making Test

Authors	Sample	N	Age (in years)		Education (in years)		Trail A Time (in secs)		Trail B Time (in secs)		Trail A Errors		Trail B errors		Trail B:A Ratio	
			M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Ruffolo et al. (2000)	Mild head injury group	62	35.9	13.4	12.6	2.2	39.5	17.7	84.6	42.1	0.27	0.52	0.50	0.74	2.14	-
	Moderate-severe head injury group	46	29.8	11.4	11.9	1.7	39.6	31.5	90.3	41	0.17	0.44	0.59	0.93	2.28	-
	Suspected malingerers	7	31.3	6.1	11.3	3.4	69.6	33	160.9	78.3	0.29	0.49	1.57	1.81	2.31	-
	Simulated malingerers	31	30.3	12.9	15	2.4	103.3	46.9	116.6	37.4	2.87	2.13	3.65	2.59	1.13	-
	Normal controls	49	29.1	12.1	14.3	1.9	26.6	7.9	57.2	17.2	0.14	0.41	0.47	0.77	2.15	-
Iverson et al. (2002)	Uncomplicated mild TBI patients	328	31.6	12.2	12.3	2.3	30.99	12.77	82.39	44.63	0.21	0.48	0.63	0.98	2.75	1.11
	Mild TBI with skull fracture patients	86	30.2	11.5	11.7	1.8	34.40	15.90	94.41	51.12	0.26	0.46	0.88	1.51	2.87	1.37
	Complicated mild TBI patients	117	34.8	14.4	12.2	2	36.77	15.03	104.93	48.85	0.15	0.45	0.86	1.38	2.98	1.15
	Moderate-Severe TBI patients	40	34.7	15	11.8	1.8	50.78	28.36	154.65	68.81	0.15	0.43	0.88	1.72	3.32	2.01
	Non- malingering very mild TBI patients	77	38.9	10.8	12.2	2.8	27.69	8.87	67.84	26.79	-	-	-	-	2.57	1.01
	Non-malingering well-defined TBI patients	83	34.4	13.7	11.4	2.6	32.14	13.82	79.59	46.60	-	-	-	-	2.51	1.03
	Suspected malingering combined TBI patients	69	-	-	-	-	44.27	18.98	122.75	80.60	-	-	-	-	2.83	1.46
O'Bryant et al. (2003)	Suspected malingerers	27	44.5	11.7	12.3	1.8	73.4	36.3	143.4	74.9	0.43	0.63	0.81	1.27	2.01	0.58
	Non-malingerers	67	39.6	12.5	13.5	2.8	41.7	20.1	100.1	61.8	0.13	0.49	0.37	0.67	2.44	0.99
Egeland & Langfjaeran (2007)	Litigating possible malingerers	41	44	11	10.2	2.2	61	22	147	68	-	-	-	-	2.47	0.94
	Litigating impaired participants	30	44	12	10.2	1.4	44	19	121	67	-	-	-	-	2.76	1.05
	Litigating normal controls	17	42	13	10.8	1.5	41	17	118	65	-	-	-	-	2.89	0.98

Table 5

Summary Table of Cut-Off Scores from Reviewed Studies for the Trail Making Test

Authors	Sample	N	Cut-off					Sensitivity (%)	Specificity (%)
			Trail A Time (in seconds)	Trail B Time (in seconds)	Trail A Errors	Trail B Errors	Trail B:A Ratio		
Ruffolo et al. (2000)	Mild head injury group	62	-	-	≥ 4[a]	≥ 4[a]	-	-	-
	Moderate-severe head injury group	46	-	-	≥ 4[a]	≥ 4[a]	-	-	-
	Suspected malingerers	7	-	-	≥ 4[a]	≥ 4[a]	-	-	-
	Simulated malingerers	31	-	-	≥ 4[a]	≥ 4[a]	-	-	-
	Normal controls	49	-	-	≥ 4[a]	≥ 4[a]	-	-	-
Iverson et al. (2002)	Non-malingering very mild TBI group	77	≥ 63[b]	≥ 200[b]	-	-	≤ 1.49[b]	-	100[c]/100[d]87[e]
	Non-malingering well-defined TBI group	83	≥ 63[b]	≥ 200[b]	-	-	≤ 1.49[b]	-	97.6[c]/95.25[d]/89.2[e]
	Suspected malingering very mild TBI group	42	≥ 63[b]	≥ 200[b]	-	-	≤ 1.49[b]	16.76[c]/7.1[d]/ 2.4[e]	-
	Suspected malingering well-defined TBI group	27	≥ 63[b]	≥ 200[b]	-	-	≤ 1.49[b]	11.1[c]/18.5[d]/ 7.4[e]	-
	Non-malingering combined TBI group	160	≥ 63[b]	≥ 200[b]	-	-	≤ 1.49[b]	-	98.8[c]/97.5[d]/88.1[e]
	Malingering combined TBI group	69	≥ 63[b]	≥ 200[b]	-	-	≤ 1.49[b]	14.5[c]/11.6[d]/ 4.3[e]	-
O'Bryant et al. (2003)	Suspected malingering group	27	-	-	-	-	-	63[f]	-
	Non-malingering control group	67	-	-	-	-	-	-	45[f]
Egeland & Langfjaeran (2007)	Litigating possible malingerers	41	-	-	-	-	< 2.5	68	-
	Litigating impaired participants	30	-	-	-	-	< 2.5	-	57
	Litigating normal controls	17	-	-	-	-	< 2.5	-	57

[a]This cut-off score is based on the results of comparisons between the five participant groups utilised in this study

[b]These cut-off scores were based on performances by a TBI patient group with varying severities of head injuries. Cut-off scores were devised from those scores that were at or below the 5th percentile for this sample. [c]Based on time on Trail A [d]Based on time on Trail B [e]Based on Trail B:A ratio

[f]No definite cut-offs were given and sensitivity and specificity rates were based on the Trail B:A ratio scores.

generally having at least 12 years of education, and frequently even tertiary education (Arnett et al., 1995; Axelrod et al., 2006; Babikian et al., 2006; Egeland & Langfjaeran, 2007; Fisher & Rose, 2005; Greiffenstein et al., 1994; Inman & Berry, 2002; Iverson et al., 2002; Iverson & Tulsky, 2003; Larrabee, 2003; Lee et al., 1992; O'Bryant et al., 2003; 2007; Rees et al., 1998; Ruffolo et al., 2000; Teichner & Wagner, 2004; Tombaugh, 1996, 1997; Yanez et al., 2006). Subsequently, no data are currently available that examine the utility of these cut-off scores in different cultures, in people whose first language is not English, and in people with varying levels and quality of education. However, these factors cannot be ignored, as they have each been shown to play an important role in neuropsychological test performance (Ardila, 2005; Roselli & Ardila, 2003; Shuttleworth-Edwards, Donnelly, Reid & Radloff, 2004; Shuttleworth-Edwards, Kemp et al., 2004; Nell, 1999; Shuttleworth-Jordan, 1996). Each of these factors will therefore be explored briefly below.

1.5.1 Culture

It has been well documented and accepted that culture plays a role in neuropsychological testing, given that this, like any other social situation, is governed by commonly accepted cultural rules (Ardila, 2005; Shuttleworth-Edwards, Donnelly et al., 2004; Shuttleworth-Edwards, Kemp et al., 2004; Shuttleworth-Jordan, 1996; Rosselli & Ardila, 2003). Commonly used neuropsychological tests are generally developed on the basis of middle-class, westernised ways of thinking and understandings of intelligence. As a result, poor test performance in individuals from different cultures may be a reflection of different cultural interpretations, rather than an indication of a low level of cognitive functioning (Ardila, 2005; Nell, 1999; Rosselli & Ardila, 2003; Shuttleworth-Edwards, Kemp et al., 2004; Shuttleworth-Jordan, 1996).

In other words, variations in neuropsychological test performance depend on differences in "acculturation" to middle-class westernised cultures (Byrd, Touradji, Tang & Manly, 2004; Helms, 1992; Shuttleworth-Edwards, Kemp et al., 2004). Acculturation is the extent to which an individual has adopted the values and traditions of westernised culture as their own, and this has been found to be a more potent variable than the ethnicity or race of the individual being tested (Byrd et al., 2004; Helms, 1992; Shuttleworth-Edwards, Kemp et al., 2004).

Nell (1999) suggests that an important factor to be considered when applying psychological tests to different cultures is the level of test-wiseness of the individual being tested. He argues that, in western societies, test-

taking skills are "absorbed" rather than directly taught, and it is therefore taken for granted that when a test of any type is being taken, one needs to be highly motivated, needs to apply a high level of concentration on the task at hand, and needs to work both as accurately and as quickly as possible (Nell, 1999; Shuttleworth-Edwards, Kemp et al., 2004). On the other hand, individuals from non-westernised cultures may not have a high level of test-wiseness, and may believe that it is more important to produce accurate and careful work, regardless of the time taken to complete it (Helms, 1992). As such, individual test performance will be impacted by the type of educational institution attended. The factor of culture is thus closely inter-related to the factors of quality and type of education received and language, which will be discussed further below.

1.5.2. Level and Quality of Education

Much research has been conducted evidencing a relationship between level of education and improved neuropsychological test performance (Lezak et al., 2004; Shuttleworth-Edwards, Donnelly et al., 2004). However, in South Africa, level of education is a less accurate predictor of test performance than quality of education, given that differing qualities and types of education were made available to varying race groups in this country under the legislature of the Apartheid system (Shuttleworth-Edwards, Donnelly et al., 2004). As such, the majority of black people in South Africa attended schools run by the former Department of Education (DET schools), which received a substantially lower amount of financial resources than schools attended to by white children (Claassen, Krynauw, Paterson & Mathe, 2001).

Although these disparities in educational systems no longer officially exist, former DET type schools still receive education that is of a significantly lower standard to that received at Model C/private schools, with former DET type schools placing an increased emphasis on rote learning rather than focussing on problem-solving ability like the model C/private schools (Grieve & Viljoen, 2000). Furthermore, problems continue to persist in former DET type schools, especially in the Eastern Cape, where significant shortages of teachers, furniture, buildings, textbooks and stationery are forcing pupils to leave school early (Matomela, 2008). Quality of education is therefore an especially potent variable in neuropsychological test performance in this area in South Africa, as poor test results are likely to be a reflection of the type of education received rather than actual cognitive ability.

Accordingly, a recent study conducted by Shuttleworth-Edwards, Kemp et al. (2004) illustrates the impact of quality of education on neuropsychological test performance. In this study, it was found that scores on the English administration of the Wechsler Adult Intelligence Test Version III (WAIS-III) for white, English

first language speakers and black, indigenous South African first language speakers with advantaged educational backgrounds were reliably comparable to normative data taken from the United States. On the other hand, scores for black indigenous South African language speakers with relatively disadvantaged educational backgrounds (former DET-type education) were found to be substantially (approximately 20 IQ points) lower than US norms (Shuttleworth-Edwards, Kemp et al., 2004). These findings therefore indicate

that, regardless of whether or not English is the first language of an individual, if that individual has attended an advantaged educational institution, he/she is more likely to obtain higher scores on cognitive tests. However, the factor of language is very closely linked to the factor of quality of education and both of these play an equally important role in neuropsychological test performance.

1.5.3 Language

Standard neuropsychological tests are generally developed in middle-class, westernised countries, where English is the first language and, as a result, standard test instructions assumed to be easily understandable for all participants, may be misinterpreted by people whose first language is not English and who may have different understandings of words and concepts to those expected by the test developers and administrators (Ardila, 2005). In South Africa, there are 11 official languages, each of which has a further number of varying dialects. As a result, it would not be viable to translate standard neuropsychological tests into the relevant language of the test taker, as translation would be very costly and there would be too many different translations required. Furthermore, standard neuropsychological tests, administered in English, including those used to assess malingering reviewed above, have been well-established and validated on wide ranges of samples. Normative data currently available for these tests are additionally based on them being administered in English. Consequently, it is more feasible to administer these neuropsychological tests in their standardised English form and obtain appropriate normative data for second language English speakers, such as has been the model in the research conducted by Shuttleworth-Edwards and her colleagues (Shuttleworth-Edwards, Donnelly et al., 2004; Shuttleworth-Edwards, Kemp et al., 2004; Shuttleworth-Jordan, 1996).

Using this model in the study described above, Shuttleworth-Edwards, Kemp et al. (2004) found that black indigenous South African language speakers who had received an advantaged education performed to a level comparable to the United States normative data on the WAIS-III (Shuttleworth-Edwards, Kemp et al., 2004). It may be extrapolated that a possible reason for these differences in performance between black,

indigenous language speakers with a more advantaged educational background and those who were schooled in former DET-type schools, is that the former participant group was likely to have had a better grasp of the English language. This is attributable to the fact that advantaged educational institutions teach in the medium of English and students who attend these institutions therefore develop a relatively high level of English proficiency, even if English is not their first language. On the other hand, in former DET-type schools, English is frequently not the language of tuition and students are only required to learn it as a subject at second-language level. It can therefore be seen that the factors of language and quality of education are strongly enmeshed. This is further highlighted in the work of Manly, Byrd, Touradji, Sanchez & Stern (2004), which has indicated that reading level is one of the strongest predictors of neuropsychological test performance and is partly reflective of quality of education. These findings therefore illustrate the importance of language in neuropsychological test performance and also show the intricate link between the factors of language and education.

Overall, culture, language, and quality of education, are necessary variables to be considered when applying any neuropsychological tests to the South African context. Given the significant role of malingering in neuropsychological assessment, especially considering the possibility of financial compensation for those people deemed to be neuropsychologically impaired, such normative indicators for this population should be obtained for the English administration of those tests commonly used to detect malingering too, seeing as current norms and cut-off scores are only available in respect of more advantaged populations. Considering the particularly poor quality of education delivered in the Eastern Cape province, it is especially important that appropriate normative data be obtained for the people who have received a relatively disadvantaged education in this area in South Africa.

1.6 Objectives of Current Study

Taking the above review of the literature into account, this study subsequently aims to obtain normative data for the four tests examined above, administered in English, from a relatively disadvantaged population of black South Africans with no tertiary education, who attended a previously disadvantaged (former DET-type) school in the Eastern Cape, and who speak Xhosa as their first language. The normative scores obtained from this study can then be compared to current cut-off scores in order to establish whether these can viably be used in this population as indicators of malingering, or whether this population generally perform at a lower level and will thus attain lower than expected scores, even when they are not malingering.

As such, this study aimed to meet the following specific objectives:

1.) To attain normative data (means and standard deviations) for the TOMM, the Rey-15 Item Memory Test, the Digit Span subtest of the WAIS-III, and the Trail Making Test, administered in English, on a population of black, South African, Xhosa-speaking people, who attended a former DET-type school in the Eastern Cape, with a Grade 11-12 level of education, in the age range of 18-40 years.

2.) To establish tables of cut-off scores indicative of malingering for the TOMM, the Rey-15 Item Memory Test, the Digit Span subtest of the WAIS-III, and the Trail Making Test, administered in English, on a population of black, South African, Xhosa-speaking people, who attended a former DET-type school in the Eastern Cape, with a Grade 11-12 level of education, in the age range of 18-40 years.

3.) A subsidiary aim was to investigate any differences for younger and older age (18-29 versus 30-40) and gender within the sample to identify whether there was a need for separate normative indications and cut off scores for either of these factors.

2. Method

2.1 Sample

A non-clinical sample of 33 black participants with Xhosa as their first language, ranging in age from 18-40 years (mean age = 28.39 years; SD = 5.989), was utilised in this study. All participants were born in, attained their education from, and currently reside in, the Eastern Cape province in South Africa. Participants were drawn from this province, as this area has been identified as one where the quality of education is particularly poor, even when compared to that obtained from former DET-type schools in other provinces (Matomela, 2008). The majority of the participants (n=19) held jobs as casual workers at the Rhodes University campus, primarily in the housekeeping and grounds and gardens departments. Several others (n=7) held various jobs at a fast food outlet in Grahamstown, primarily working in the kitchen or as waitrons. The remaining 7 participants were unemployed at the time of the study.

2.1.1 Language

Xhosa is the most prominent of the 11 official South African languages spoken in the Eastern Cape province. Subsequently, in order to ensure as much homogeneity as possible in the sample, all participants included spoke Xhosa as their first language. However, as all of the tests included in this study were administered in English, it was also necessary to ensure that all participants were proficient in English. As a result, only people who either worked in an English environment at the time of the study, or had previously worked in an English environment, were included in the sample. Rhodes University is an English environment and all participants who were casual workers on the university campus received work instructions and communicated with their supervisors in the medium of English. The participants who worked at a fast food outlet similarly spoke in English to their supervisors and customers. Additionally, all participants who were unemployed at the time of the study had previously held jobs in which they were required to communicate in English on a daily basis. All participants were questioned extensively at the time of testing about their English language usage in order to ensure that they all spoke this language on a regular basis. Furthermore, all participants were required to have passed English as a second language school subject at the Grade 11 or Grade 12 level. This was assessed by reviewing the participants' school reports and/or Matric certificates and looking at the marks that they had attained for English. Participants

also gave a subjective rating from poor to excellent of their grasp of the English language and were questioned about their reasons for the rating given on the pre-test screening questionnaire administered to them at the time of testing (see Appendix B). It was not considered necessary to exclude any of the participants on the basis of not being proficient in English for any of these screening procedures adopted.

2.1.2 Level and Quality of Education

The sample included participants who had acquired at least a Grade 11 level of education, with no tertiary education. This would ensure that participants had attained a high level of senior school education without having studied further, thereby representing the normal population. As previously discussed in the literature review section above, differing qualities and types of education were offered to varying race groups under the Apartheid regime, with the black people receiving education from former DET schools. Although this DET system of education no longer officially exists, former DET schools found in the more economically disadvantaged areas of South Africa, such as the townships or locations and particularly in the Eastern Cape, still receive a poorer quality of education to other types of schools in this country (see literature review above). Subsequently, all participants included in this sample were required to have received their education from a township or former DET type school in the Eastern Cape.

2.1.3 Age

The sample was stratified into two groups according to age in order to assess whether age would have an effect on test performance on any of the measures of malingering utilised in this study. As such, the participants were divided into a group of 18-29 year olds (n = 17; mean age = 23.65 years, SD = 3.463; mean education = 11.76 years, SD = 0.437) and a group of 30-40 year olds (n = 16; mean age = 33.44 years, SD = 3.326; mean education = 11.69 years, SD = 0.479). There were no significant differences in distribution of highest grade achieved or of gender between the two age groups (p = > 0.05 in both instances). The distribution tables and Pearson Chi-Square data for highest grade obtained and gender in the two age groups are presented in Tables 6 and 7 respectively.

The complete age range of 18-40 was chosen, as people located within this age range are most at risk for suffering from a TBI.

Table 1
Distribution of Highest Grade Obtained in the Two Age Groups

			Grade		
			11	12	Total
Age	18-29 yrs	Count	4	13	17
		% within Age	23.5%	76.5%	100.0%
	30-40 yrs	Count	5	11	16
		% within Age	31.2%	68.8%	100.0%
	Total	Count	9	24	33
		% within Age	27.3%	72.7%	100.0%

Pearson Chi-Square $p = 0.619$

Table 7
Distribution of Gender in the Two Age Groups

			Gender		
			Female	Male	Total
Age	18-29 yrs	Count	10	7	17
		% within Age	58.8%	41.2%	100.0%
	30-40 yrs	Count	11	5	16
		% within Age	68.8%	31.2%	100.0%
	Total	Count	21	12	33
		% within Age	63.6%	36.4%	100.0%

Pearson Chi-Square $p = 0.554$

2.1.4 Gender

The sample was divided into two groups according to gender in order to explore whether gender would have an effect on test performance on the measures of malingering used in this study. The female group consisted of 21 participants, with a mean age of 28.90 years (SD = 6.7) and a mean level of education of 11.76 years (SD = 0.436). The male group comprised of 12 participants, with a mean age of 27.50 years (SD = 4.622) and a mean level of education of 11.67 years (SD = 0.492). There were no significant differences in the

distribution of highest grade completed or age between the two gender groups ($p = > 0.05$ in both instances). Distribution tables and Pearson Chi-Square data for highest grade obtained and age in the two gender groups are displayed in Tables 8 and 9 respectively.

Table 8
Distribution of Highest Grade Obtained in the Two Gender Groups

			Highest_Grade		
			11	12	Total
Gender	Female	Count	5	16	21
		% within Gender	23.8%	76.2%	100.0%
	Male	Count	4	8	12
		% within Gender	33.3%	66.7%	100.0%
	Total	Count	9	24	33
		% within Gender	27.3%	72.7%	100.0%

Pearson Chi-Square $p = 0.555$

Table 9
Distribution of Age in the Two Gender Groups

			Age		
			18-29 yrs	30-40 yrs	Total
Gender	Female	Count	10	11	21
		% within Gender	47.6%	52.4%	100.0%
	Male	Count	7	5	12
		% within Gender	58.3%	41.7%	100.0%
	Total	Count	17	16	33
		% within Gender	51.5%	48.5%	100.0%

Pearson Chi-Square $p = 0.554$

2.1.5 Exclusion Criteria

Exclusion criteria included: any reported history of a neurological disorder or traumatic brain injury (loss of consciousness > 1 hour); any current psychiatric disorder; any prenatal or birth complications; a history of learning disability; the need for special education; two or more repeated school grades; the current use of psychotropic medications; a diagnosis of substance abuse or recreational drug use in the year prior to

testing; or an admission to a rehabilitation facility or ward for substance abuse. The application of these criteria ensured that the participant group would be representative of a non-clinical population of normal, well-functioning individuals within this population. Information regarding these exclusion criteria was based on self-report and was obtained from an initial biographical questionnaire (see Appendix A) completed by all prospective participants, as well as from an additional pre-test screening questionnaire (see Appendix B) completed by all participants at the time of testing.

2.3 Procedure

This study formed part of a larger research investigation into the collection of normative data on the same sample for sixteen neuropsychological measures across a spectrum of functional modalities.

2.3.1 Data Collection

The research was conducted in Grahamstown, in the Eastern Cape province and Rhodes University was chosen as a research site for the purpose of convenience. Permission was first acquired from the registrar to utilise this university as a research site. The researchers also liaised with the Human Resources department of this university to use staff from Rhodes University as participants for this study. This department then identified the casual staff from this university as a suitable sample group who met the required criteria for this study. Thereafter, the researchers were granted access to the entire database of Rhodes University casual staff. The researchers searched this database and compiled a list of individuals who had completed a Grade 11 or Grade 12 level of education.

The identified individuals were contacted and invited to attend one of two research presentations held by the research team. The individuals were informed that any transport costs (standard taxi fares) would be reimbursed following attendance at one of these presentations. During these presentations, the prospective

participants were given information about the purpose of the study, as well as details of what their participation in it would entail. They were also asked to complete a biographical questionnaire (see Appendix A). The information obtained from this questionnaire allowed the researchers the opportunity to identify participants who met the inclusion criteria for the study. These participants were contacted and invited to participate in the research if they so desired. During this process, it became apparent that only a small number of suitable participants would be willing and able to participate in the study. Subsequently, the

researchers then utilised snowball sampling, asking the existing sample to identify further prospective participants. These participants were then contacted and asked to complete the biographical questionnaire (see Appendix A), and those who met the inclusion criteria for the study were invited to participate. All participants were offered a voucher from Steers valued at R100,00 as a means of encouraging participation in the study.

Once the sample had been identified, an equal number of participants was randomly allocated to each member of the research team. The research team consisted of three intern clinical psychologists and one intern counselling psychologist, all of whom had been trained in the administration and scoring of each test administered in this study by a qualified clinical psychologist. The four members of the research team also practiced administering the entire battery of neuropsychological tests utilised in this study on each other in order to ensure a consistent and standardised method of test administration. Thereafter, each researcher tested the participants that they had been allocated. At the time of testing, each researcher clearly stipulated the voluntary nature of participation in this study and a consent form was explained to and signed by each participant (see Appendix C for the consent form). The researcher then administered a pre-test screening questionnaire (see Appendix B), as well as a battery of neuropsychological tests in English, and in a standardised order, to each participant.

2.3.2 Materials

Four tests commonly used as measures of malingering were administered as part of the battery of 16 standard neuropsychological measures that were involved in the larger study covering a spectrum of functional modalities (see Table 10 for a list of all the tests included in the neuropsychological test battery utilised in this study, written in the order in which they were routinely administered on all test occasions). The results of these tests were utilised as data for another three research studies. However, for the purposes of this study, the results of the following tests (which have been reviewed in the literature review section above) were used and examined further:

The test of memory malingering (TOMM). The TOMM is a recognition task containing two learning trials and an optional retention trial. During the two learning trials, participants are shown 50 items for 3 seconds each and are then shown 50 recognition panels containing 2 pictures, only 1 of which was previously shown

Table 10

Order of Presentation of Tests in the Overall Neuropsychological Test Battery with Emphasis on Tests in the Present Study.

Name of Test	Author
1. Wechsler Memory Scale (WMS) Reproduction for Designs - Immediate Recall	Wechsler, 1945
2. Wechsler Memory Scale (WMS) Paired Associates - Immediate Recall	Wechsler, 1945
3. Successive Finger Tapping Test	Denckla, 1973
4. Purdue Pegboard	Tiffin & Asher, 1948
5. Trail Making Test – Trail A and Trail B	Reitan, 1956
6. Wechsler Memory Scale (WMS) Reproduction for Designs - Delayed Recall	Wechsler, 1945
7. Wechsler Memory Scale (WMS) Paired Associates - Delayed Recall	Wechsler, 1945
8. Digit Span Subtest of WAIS-III - Forwards and Backwards	Wechsler, 1997
9. Rey-Osterreith Complex Figure – Copy and Immediate Recall	Osterreith, 1944
10. TOMM - Trial 1 and Trial 2	Tombaugh, 1996
11. Words-in-a-Minute	Baker & Leland, 1967
12. 'S' Words-in-a-Minute	Benton, Hamsher, & Sivan, 1994
13. Stroop Test	Golden, 1978
14. TOMM - Retention Trial	Tombaugh, 1996
15. Rey-Osterreith Complex Figure - Delayed Recall	Osterreith, 1944
16. Rey 15-Item Memory Test	Rey, 1964

to them. Participants are required to point to the picture which has been viewed previously. The retention trial is administered approximately 15 minutes after Trial 2. During this trial, the participant is only shown 50 recognition panels and required to point to the picture they have seen previously. On each trial, 1 point is given for every correct answer, giving a total score out of 50 for each trial. Although the retention trial is optional and is usually only required to be administered if participants received less than 45 out of 50 on Trial 2 (Tombaugh, 1996), it was decided that this trial would be administered to all participants regardless of their Trial 2 score in this study. Although scores from all three trials of the TOMM were obtained and reported below, only the scores from Trial 2 and the retention trial were analysed in more detail (to make up two measures in respect of the TOMM), as the cut-off score of 45 is applied to these two trials only.

The rey 15-item memory test. The Rey 15-Item Test is a simple visual recall task, which is presented as being very difficult. In this task, participants are shown a card with 15 stimuli, with 3 different items displayed on 5 rows. The stimulus card is shown to the participant for 10 seconds and then taken away. The participant is then required to reproduce the stimuli on a piece of paper provided. Although the words "15" and "different" are emphasised, patients are actually only required to remember a maximum of five ideas to correctly recall and reproduce the stimulus items (Arnett et al., 1995; Inman & Berry, 2002; Lee et al., 1992; Lezak et al., 2004). Various scores can be taken from this test and for the purposes of this study, the scores of the total number of items correctly recalled, regardless of spatial location and the total number of correct rows produced in their correct spatial location (to make up two measures in respect of the Rey 15-Item Test) were recorded.

The digit span subtest of the WAIS-III. The Digit Span subtest of the WAIS-III consists of two parts, the Digit Span forwards and the Digit Span backwards. In the first part (Digit Span forwards), participants are read a string of numbers and are immediately required to repeat the numbers in the exact order in which they were read. The strings of numbers are increased in length after two trials. The task ends when the participant fails both trials of a given string length. The second part (Digit Span backwards) is administered in the same manner as the digit span forwards, except that participants are required to recite numbers in the reverse order to which they were read. Several scores may be obtained from this subtest, but for the purposes of this study, only the Age-Correlated Scaled Scores (ACSS) and Reliable Digit Span (RDS) were used (to make up two measures in respect of the Digit Span test), as these are the scores most commonly utilised for the assessment of malingering (Axelrod et al., 2006; Babikian et al., 2006; Inman & Berry, 2002; Iverson & Tulsky, 2003; Larrabee, 2003). ACSS scores were obtained from the tables found in the WAIS-III administration and scoring manual. The RDS was calculated as specified by Greiffenstein et al. (1994), whereby the longest string of numbers attained over two trials on the Digit Span forwards is added to the longest string of digits attained over two trials on the Digit Span backwards.

The trail making test (trails A & B). The Trail Making Test is a commonly used neuropsychological test, which assesses visuomotor speed, cognitive flexibility, sequencing and set shifting ability (Iverson et al., 2002). It consists of two parts, known as Trail A and Trail B. On Trail A, the participant is given a page on which a set of numbers in circles have been scattered. The participant is required to join these circles in numerical order as quickly as possible. On Trail B, the participant is given a similar page with a set of numbers and letters in circles scattered across the page. On this trail, the participant is required to join the

circles in numerical and alphabetical order by alternating between numbers and letters, again working as quickly as they can. The following five scores were used from this test (to make up five measures in respect of the Trail Making Test), as these have been identified as those that are most commonly used to assess malingering: total completion time for Trail A in seconds; total completion time for Trail B in seconds; total number of errors made on Trail A; total number of errors made on Trail B; and the ratio of the completion time for Trail B to the completion time for Trail A (i.e. the completion time of Trail B divided by the completion time of Trail A) (Egeland & Langfjaeran, 2007; Iverson et al., 2002; O'Bryant et al., 2003; Ruffolo et al., 2000).

The various indicators from each of these tests described above together make up the following 11 measures, investigated in this study: i.) total score from Trial 2 of the TOMM; ii.) total score from the retention trial of the TOMM; iii.) total number of correct items in any position on the Rey 15-Item Memory

Test; iv.) total number of correct rows in correct position on the Rey 15-Item Memory Test; v.) Age Correlated Scaled Scores (ACSS) from the Digit Span test; vi.) Reliable Digit Span (RDS) from the Digit Span test); vii.) completion time on Trail A from the Trail Making Test; viii.) completion time on Trail B from the Trail Making Test; ix.) number of errors on Trail A; x.) number of errors on trail B; xi.) Trail B:A ratio

These four tests (11 measures) targeted for the purposes of this study, were all administered in English, in the standardised form, as specified by the respective administration and scoring manuals.

2.3.2 Data Processing

Each member of the research team scored all of the tests contained in the neuropsychological battery for each participant whom they had tested. Tests were scored in the standardised manner specified by the respective administration and scoring guidelines. A second member of the research team then re-scored all of the tests in order to ensure reliable scoring. Any discrepancies noted were resolved between the two scorers. Additionally, two participant test batteries from each member of the research team were randomly selected and counter-scored by a third member of the research team. No further discrepancies were found at this stage.

2.3.3 Data Analysis

The primary purpose of this study was to obtain normative data for a specific population group for four tests commonly used to detect malingering, with a subsidiary aim of investigating any gender or age effects on these tests. The results were analysed by using descriptive statistics, and the mean, median, mode, standard deviation, range, and percentiles were calculated for each measure of malingering used in this study. Normative tables for the four tests assessing malingering included in this study were drawn up using these data. These tables can be used for future clinical practice in South Africa. T-tests were also carried out on all measures to assess for differences in test performance between the younger and older age groups (18-29 and 30-40 respectively) and the two genders.

In addition to this, the results of this study were also compared to existing cut-off scores in order to evaluate whether or not these scores are appropriate for use as indicators of malingering in this population group. New cut-off scores appropriate for the population group utilised in this study were then proposed. These

new cut-off scores were devised by comparing the score in the 5th percentile obtained for each measure of malingering used in this study to the cut-off scores found by the other studies reviewed earlier in this paper. If this score for this population was better than the previously suggested cut-off scores, the published score was used as the cut-off score for this population group. However, if the proposed cut-off scores were shown not to be appropriate for this population (i.e. the scores from the current study were poorer than established cut-offs), the 5th percentile score was used as the new cut-off score. The majority of the previous studies reviewed established cut-off scores using formulas derived from comparisons between their various participant groups or using the scores that yielded the best sensitivity and specificity rates amongst their different sample groups. However, there was only one population group in this study, so these methods could not be utilised. As a result, the 5th percentile score was taken as the cut-off score, as this has been used as a way to devise cut-off scores for the assessment of malingering in some of the other studies reviewed in this paper (Iverson et al., 2002; Lee et al., 1992). Normative tables listing these new proposed cut-off scores were also created for use for future clinical practice on similar populations in South Africa.

3. Results

No significant differences were found on any of the 12 indicators of malingering from the four tests utilised in this study between the two age groups (18-29 and 20-40) and the two genders (males and females), using t-tests ($p = > 0.05$, in both instances). Consequently, the findings of this study will be reported in terms of the entire sample.

3.1 The TOMM

The descriptive statistics and percentiles obtained from the complete sample for the three trials on the TOMM (Trial 1, Trial 2 and retention trial) are shown in Tables 11 and 12 respectively.

Table 11
Descriptive Statistics for the TOMM

Measure	Mean	Median	Mode	Std. Deviation	Minimum	Maximum
Trial 1	45.48	48	50	6.59	21	50
Trial 2	49.82	50	50	0.58	47	50
Retention	49.61	50	50	1.09	44	50

Table 12
Percentile Scores for the TOMM

Measure	Percentile																		
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
Trial 1	26.6	35.2	41.1	43.6	44.5	46	46	46	47	48	48.7	49	49	49	50	50	50	50	50
Trial 2	48.4	49	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Retention	47.5	49	49	49	49.5	50	50	50	50	50	50	50	50	50	50	50	50	50	50

As these tables indicate, the current sample obtained a mean score of 45.48 (SD = 6.59; range = 21-50) on Trial 1 of the TOMM and mean scores of 49.82 (SD=0.58; range = 47-50) and 49.61 (SD = 1.09; range = 44-50) on Trial 2 and the retention trial respectively. Additionally, the scores in the 5th percentile for this sample were 26.6; 48.4 and 47.5 for Trials 1 and 2 and the retention trial, respectively. In other words, only five percent of this sample attained scores lower than these on each of the relevant trials.

3.2 The Rey 15-Item Memory Test

The descriptive statistics and percentiles obtained from the complete sample for the two indicators of malingering on the Rey 15-Item Test assessed in this study (number of correct items regardless of spatial location and number of correct rows in correct spatial location) are shown in Tables 13 and 14 respectively.

Table 13
Descriptive Statistics for the Rey 15-Item Memory Test

Measure	Mean	Median	Mode	Std. Deviation	Minimum	Maximum
Correct Items in Any Position	13.64	15	15	2.03	7	15
Rows in Correct Position	3.39	3	5	1.46	0	5

Table 14
Percentile Scores for the Rey 15-Item Memory Test

Measure	Percentile																		
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
Correct Items in Any Position	7.7	11.4	12	12	12	13.2	14	14	14	15	15	15	15	15	15	15	15	15	15
Rows in Correct Position	0	1.4	2	2	2.5	3	3	3	3	3	4	4	4	4.8	5	5	5	5	5

These results indicate that the sample obtained a mean of 13.64 (SD = 2.03; range = 7-15) items correct regardless of spatial location and a mean of 3.39 (SD = 1.46; range = 0-5) rows correct in the correct spatial location. Furthermore, the scores in the 5th percentile for this sample were 7.7 items correct regardless of spatial location and 0 rows correct in the correct spatial location. The score in the 10th percentile for rows correct in correct spatial location was 1.4.

3.3 The Digit Span Subtest of the WAIS-III

The descriptive statistics and percentiles obtained from the complete sample for the two indicators of malingering on the Digit Span subtest of the WAIS-III assessed in this study (Age Correlated Scaled Scores (ACSS) and Reliable Digit Span (RDS)) are shown in Tables 15 and 16 respectively.

Table 15
Descriptive Statistics for the Digit Span Subtest of the WAIS-III

Measure	Mean	Median	Mode	Std. Deviation	Minimum	Maximum
ACSS	6.91	7	5	2.08	3	11
RDS	7.42	7	7	1.6	4	10

Table 16
Percentile Scores for the Digit Span Subtest of the WAIS-III

Measure	Percentile																		
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
ACSS	3.7	4	5	5	5	5.2	6	6	7	7	7	7.4	8	8	8	9	9	10	11
RDS	4.7	5.4	6	6	6	6.2	7	7	7	7	7	8	8	8.8	9	9	9	10	10

As can be seen from the above tables, the sample obtained a mean Age Correlated Scaled Score (ACSS) of 6.91 (SD = 2.08; range = 3-11) on the Digit Span subtest of the WAIS-III. This sample obtained a mean Reliable Digit Span (RDS) of 7.42 (SD = 1.60; range = 4-10). The scores in the 5th percentile of this sample were 3.7 and 4.7 for ACSS and RDS respectively.

3.4 Trail Making Test

The descriptive statistics and percentiles obtained from the complete sample for the five indicators of malingering assessed for the Trail Making Test (Trail A completion time; Trail B completion time; number of errors on Trail A; number of errors on Trail B; ratio of completion time on Trail B to completion time on Trail A) are shown in Tables 17 and 18.

Table 17
Descriptive Statistics for the Trail Making Test

Measure	Mean	Median	Mode	Std. Deviation	Minimum	Maximum
Trail A	39.66	36.3	15.2	15.93	15.2	82.6
Trail B	90.16	82.14	36.96	36.13	36.96	185.89
Trail A Errors	0.21	0	0	0.42	0	1
Trail B Errors	1.3	0	0	2.3	0	12
Trail B:A	2.49	2.11	1.19	1.24	1.19	6.86

Table 18
Percentile Scores for the Trail Making Test

Measure	Percentile									
	5	10	15	20	25	30	35	40	45	50
Trail A	19.27	24.33	25.53	26.67	27.82	28.80	30.31	31	34.03	36.3
Trail B	46.25	52.92	56.50	59.41	64.37	67.24	70.23	76.8	80.10	82.14
Trail A Errors	0	0	0	0	0	0	0	0	0	0
Trail B Errors	0	0	0	0	0	0	0	0	0	0
Trail B:A	1.33	1.49	1.57	1.73	1.76	1.77	1.82	1.87	1.96	2.11

Table 18, ctd.
Percentile Scores for the Trail Making Test

Measure	Percentile								
	55	60	65	70	75	80	85	90	95
Trail A	38.40	40.42	42.86	43.21	46.33	51.15	59.12	68.65	74.04
Trail B	84.44	88.81	92.29	98.78	103.93	111.3	144.38	152.85	174.07
Trail A Errors	0	0	0	0	0	1	1	1	1
Trail B Errors	0.7	1	1.1	2	2	3	3	3	6.4
Trail B:A	2.15	2.26	2.34	2.51	2.97	3.25	3.40	4.35	5.94

As is evident from the results in these tables, this sample obtained a mean completion time of 39.66 seconds (SD = 15.93; range = 15.2-82.6) and a mean of 0.21 errors (SD = 0.42; range = 0-1) on Trail A. Additionally, this sample attained a mean completion time of 90.16 seconds (SD = 36.13; range = 36.96-185.89) and a mean of 1.3 errors (SD = 2.30; range = 0-12) on Trail B of the Trail Making Test. The mean ratio of completion times of Trail B to Trail A was 2.49 (SD = 1.24; range = 1.19-6.86).

It is important to note that the scores for the first four indicators of malingering on the Trail Making Test assessed in this study (Trail A completion time; Trail B completion time; number of errors on Trail A; number of errors on Trail B), a higher score indicates a poorer performance. Subsequently, for these indicators, the scores in the 95th percentile were examined instead of those in the 5th percentile. This means that for these four specific indicators, 95 percent of the current sample obtained better scores than those given or, in other words, only five percent of the sample obtained poorer scores than this. As such, this is

comparable to looking at scores in the 5th percentile of the sample for the other indicators assessed in this study.

Tables 17 and 18 indicate that the scores in the 95th percentile of this sample were a completion time of 74.04 seconds and 1 error made on Trail A and a completion time of 174.07 seconds and 6.4 errors made on Trail B. The ratio for the completion time obtained for Trail B to the completion time obtained for Trail A in the 5th percentile of this sample was 1.33.

4. Discussion

This study aimed to investigate the performances of a relatively disadvantaged population on four tests administered in English that are commonly used in the detection of malingering (the TOMM, the Rey 15-Item Memory Test, the Digit Span subtest of the WAIS-III and the Trail Making Test). The sample included 33 black, South African, Xhosa-speaking people, who attended a former DET-type school in the Eastern Cape, with a Grade 11-12 level of education, in the age range of 18-40 years. The objectives of the study were to obtain normative indicators for these four tests for this population and to compare these to the cut-off scores proposed by previous studies conducted in westernized countries on relatively advantaged populations with at least 12 years or more education, and whose first language is English. The study further aimed to devise new cut-off scores appropriate for use on this relatively disadvantaged Xhosa speaking population if deemed necessary based on current results. These new cut-off scores were established by using the 5th percentile score as the cut-off. A subsidiary objective was also to assess whether any differences were found between younger and older age groups (ages 18-29 versus 30-40) and the two gender groups on any of the tests utilised in order to determine if separate normative indicators and/or cut-off scores should be produced for any of these groups.

In terms of this final objective, no significant differences were found on the t-tests that were carried out on any of the measures used between the two age groups or the two genders. Although very few of the studies reviewed specifically investigated differences in respect of these two factors, these findings do support those of Tombaugh (1996, 1997), who found that age had no significant effects on test performance on the TOMM. Following these results, a single set of normative indications was provided and analysed for this sample.

Normative indications on the four tests revealed the need for norm adjustments in most instances, but not invariably, as follows.

4.1 The TOMM

Participants generally performed very well on the TOMM, obtaining mean scores of 45.48 (SD=6.59) on Trial 1, 49.82 (SD=0.58) on Trial 2 and 49.61(SD=1.09) on the retention trial. These means are very similar

to those attained by all non-malingering participant groups in the studies reviewed above (Greve et al., 2006; Iverson et al., 2007; Rees et al., 1998, 2001; Teichner & Wagner, 2004; Tombaugh, 1996, 1997; Yanez et al., 2006). The 5th percentile scores of 48.4 and 47.5 on Trial 2 and the retention trials respectively indicate that performances on the TOMM by the current sample are placed well above the proposed cut-off scores of < 45 on either of these trials.

Previous studies assessing the utility of this cut-off score on various normal and clinical sample groups have similarly shown excellent performances on the TOMM, even on patients with clinical depression, head injuries and dementia (Greve et al., 2006; Iverson et al., 2007; Rees et al., 1998, 2001; Tombaugh, 1996, 1997). Only one study has yielded scores falling below 45, finding that more severely demented patients than those tested in previous studies were misclassified as malingerers using the cut-off of < 45 (Teichner & Wagner, 2004; Tombaugh, 1996, 1997). The results of the present study therefore support these findings that the TOMM and the cut-off of <45 can be used with relative confidence on non-demented participants. They further build on the existing body of literature, showing that findings can be extended to Xhosa speaking individuals in the young adult age range with at least 11 years of education and with a relatively poor quality of education. A summary of the mean scores, standard deviations, 5th percentile scores, published cut-off scores and cut-off scores from the present study for the two measures from the TOMM used in this study are given in Table 19.

Table 19

Summary of Descriptive Statistics and Cut-Off Scores for the TOMM

Measure	Mean	SD	Score in 5th Percentile	Previously suggested Cut-off	Proposed Cut-off For Current Sample
Trial 1	45.48	6.59	26.6	-	-
Trial 2	49.82	0.58	48.4	45	45
Retention	49.61	1.09	47.5	45	45

4.2 The Rey 15-Item Memory Test

4.2.1 Items Correct in Any Position

Participants obtained a mean of 13.64 (SD=2.03) items correct in any spatial location. This is substantially higher than the means attained by the clinical and simulated malingering populations of Arnett et al. (1995),

Greiffenstein et al. (1994), and Lee et al. (1992). However, the head injured simulated malingerers, head injured controls and normal controls included in the study conducted by Inman and Berry (2002) all acquired means above 14. Additionally, the normal simulated malingering participants in that study obtained a very similar mean (13.70) to that scored by the current, relatively disadvantaged participants, who were exerting their best effort. The sample in the study by Inman & Berry (2002) is younger (mean ages for all participant groups less than 19 years) than those in the other studies reviewed (mean ages ranging from 20.6 – 39.3 years). However, no significant differences were found between the younger and older age groups (18-29 versus 30-40) included in the current study, and it is therefore unlikely that age accounts for the relatively better performance by participants in the Inman and Berry (2002) study.

The score in the 5th percentile for this sample is 7.7, which falls below the published cut-off scores of < 9 or < 10, as suggested by Greiffenstein et al. (1994) and Inman and Berry (2002). On the other hand, this is higher than the cut-off of < 7 correct items in any location recommended by Lee et al. (1992). These results therefore suggest that the cut-off score proposed by Lee et. al (1992) is the most appropriate for use on this population, and it was therefore adopted here.

4.2.2 Rows Correct in Correct Position

In terms of rows correct in correct spatial location, a mean of 3.39 (SD=1.46) was obtained in the current study. The only other study reviewed to investigate this measure was that conducted by Arnett et al. (1995), which yielded mean scores ranging from 1.52 - 3.32. That study utilised neurological patients and simulated malingerers, and it would therefore be expected that scores obtained from that sample would be lower than those attained by the Xhosa speaking, normal population utilised in the current study.

As the score in the 5th percentile for this measure was 0, the 10th percentile score was examined instead. This score was 1.4, thus falling below the cut-off of < 2 rows correct in correct position proposed by Arnett et al. (1995). This proposed cut-off score therefore appears to be too stringent for this sample and a new cut-off score of $\leq$ 1 row correct in correct position was established after converting the 10th percentile score to a whole number.

A summary of the mean scores, standard deviations, 5th percentile scores, published cut-off scores and cut-off scores from the present study for the two measures from the Rey 15-Item Memory Test used in this study is given in Table 20.

Table 20

Summary of Descriptive Statistics and Cut-Off Scores for the Rey 15-Item Memory Test

Measure	Mean	SD	Score in 5th Percentile	Previously suggested Cut-off			Proposed Cut-off For Current Sample
Items Correct in Any Position	13.64	2.03	7.7	< 7[a]	< 9[b]	<10[c]	<7
Rows Correct in Correct Position	3.39	1.46	0 (1.4 in 10th percentile)	< 2[d]			≤ 1

[a]Suggested in Lee et al. (1992)
[b]Suggested in Greiffentstein et al. (1994) & Inman & Berry (2002)
[c]Suggested in Greiffenstein et al. (1994)
[d]Suggested in Arnett et al. (1995)

4.3 The Digit Span Subtest of the WAIS-III

4.3.1 Age Correlated Scaled Scores (ACSS)

The current sample obtained a mean ACSS score of 6.91 (SD=2.08) on the Digit Span subtest of the WAIS-III. This generally falls below the mean ACSS scores (ranging from 6.2 – 10.6) attained by the clinical, suspected malingering, and normal control sample groups utilised in previous studies assessing this measure (Axelrod et al., 2006; Babikian et al., 2006; Iverson & Tulsky, 2003). Additonally, the mean ACSS scored by the current normal, Xhosa speaking population with a former DET-type education is the closest to those means obtained by the suspected malingering groups in the studies conducted by Babikian et al. (2006) (mean ACSS score for suspected malingerers = 6.2) and Axelrod et al. (2006) (mean score for suspected malingerers = 6.3). This therefore reveals that the current sample performed at a level substantially below what would ordinarily be expected from a normal westernised population and, in fact, obtained scores similar to participants suspected of malingering.

Furthermore, the 5th percentile score of 3.7 is substantially lower than the published cut-off scores of ≤ 7 and ≤ 5 proposed by Axelrod et al. (2006) and Babikian et al. (2006) respectively. It is also lower than one of the cut-off scores proposed by Iverson and Tulsky (2003) (ACSS< 5). As a result, a new cut-off score was proposed for this sample, converting the 5th percentile score to a round number for use as an ACSS.

This, then, gives a cut-off score of ACSS < 4, consistent with the second cut-off score suggested by Iverson and Tulsky (2003).

4.3.2 Reliable Digit Span (RDS)

In terms of RDS, the mean score of this sample was 7.42 (SD=1.6). This is lower than the mean scores obtained by all the simulated malingering, head injured, normal control and mixed clinical sample groups included in previous studies, which attained mean RDS scores ranging from 8.09 – 11.58 (Axelrod et al., 2006; Babikian et al., 2006; Greiffenstein et al., 1994; Inman & Berry, 2002). The only participants to acquire lower RDS scores than the current sample were the suspected malingerer groups included in the studies conducted by Axelrod et al. (2006), Babikian et al. (2006), and Greiffenstein et al. (1994), thereby showing similar results to those obtained from the ACSS measure of the Digit Span test. Consequently, these findings show that the Xhosa speaking group with a poor quality of education utilised in this study generally obtained RDS scores far below all other participant groups used previously, only surpassing those obtained by probable malingerers.

Further, examining the score placed in the 5th percentile (4.7) shows that the current published cut-off scores of ≤ 6, < 7 and < 8 recommended by Babikian et al. (1994), Greifenstein et al., Inman and Berry (2002) and Larrabee (2003) respectively, would incorrectly classify participants from this sample as malingerers. As a result, a new cut-off score of RDS < 5 was established.

A summary of the mean scores, standard deviations, 5th percentile scores, published cut-off scores and cut-off scores from the present study for the two measures from the Digit Span subtest of the WAIS-III used in this study is given in Table 21.

Table 21

Summary of Descriptive Statistics and Cut-Off Scores for the Digit Span Subtest of the WAIS-III

Measure	**Mean**	**SD**	**Score in 5th Percentile**	**Previously suggested Cut-off**				**Proposed Cut-off For Current Sample**
ACSS	6.91	2.08	3.7	< 4 or 5[a]	< 6[b]	< 7[c]	< 8[d]	< 4
RDS	7.42	1.6	4.7	≤ 5[b]	≤ 7[e]			< 5

[a]Suggested in Iverson & Tulsky (2003) [b]Suggested in Babikian et al. (2006)
[c]Suggested in Greiffenstein et al. (1994) [d]Suggested in Greiffenstein et al. (1994), Larrabee (2003) & Inman & Berry (2002)
[e]Suggested in Axelrod et al. (2006)

4.4 The Trail Making Test

4.4.1 Trail A and Trail B Completion Times

The current sample obtained a mean completion time of 39.66 seconds (SD=15.93) on Trail A and 90.16 seconds (SD=36.16) on Trail B. Participants showed similar comparative patterns of performance relative to the means obtained from previous studies in terms of completion time on both Trails A and B, generally taking longer to complete both trails than all non-litigating normal control groups and non-malingering mild TBI patient groups utilised in these studies (mean completion times ranging from 20.10-39.5 and 57.2-90.3 seconds for Trails A and B respectively) (Iverson et al., 2002; Ruffolo et al., 2000). On the other hand, the mean completion times attained by the current sample are substantially shorter than those acquired by suspected and simulated malingerers, more severely head injured patients, and litigating normal controls on both trails (mean completion times ranging from 41-103.3 and 94.41-160.9 seconds for trails A and B respectively) (Egeland & Langfjaeran, 2007; Iverson et al., 2002; O'Bryant et al., 2003; Ruffolo et al., 2000). These mean comparisons therefore suggest that although the current Xhosa speaking sample with a poor quality of education generally performed slightly worse on the completion time measures on Trails A and B than westernised samples of non-litigating normal control and mildly head injured groups, they still obtained better scores (lower times) on this measure than malingering, litigating, and severely head injured participants, as would be expected.

An examination of the scores falling in the 5th percentile (74.04 and 174.07) seconds on Trails A and B respectively; a higher score indicates a poorer performance on this measure) reveals that the current sample performed at a poorer level than the cut-off score of $\geq$ 63 seconds on Trail A, but at a superior level to the cut-off of $\geq$ 200 seconds on Trail B proposed by Iverson et al. (2002). As a result, it was necessary to establish a new cut-off score of $\geq$ 74 seconds for Trail A. However, no adjustments needed to be made to existing indications of malingering for Trail B.

4.4.2 Trail A and Trail B Errors

Regarding the number of errors made on Trail A and Trail B, the participants of this study made a mean of 0.21 errors (SD=0.42) on Trail A and 1.3 errors (SD=2.3) on Trail B. The mean error score obtained on Trail A by the sample in this study is higher (which indicates a poorer performance) than the mean errors

made on all normal non-litigating control groups and three groups of mild-moderately head injured participants used in previous studies (mean errors ranging from 0.13-0.17) (Iverson et al., 2002; O' Bryant et al., 2003; Ruffolo et al., 2000). On the other hand, all malingering, litigating control and other head injured participant groups made a higher number of mean errors on Trail A than the participants in this study (Iverson et al., 2002; O'Bryant et al., 2003; Ruffolo et al., 2000). Mean comparisons between errors made on Trail B on this study and published studies reveals that all participant groups in previous studies made less errors on this trail than the current sample (mean errors from previous studies ranging from 0.37-0.88), with the exception of one simulated malingering and one suspected malingering group (Iverson et al., 2002; O'Bryant et al., 2003; Ruffolo et al., 2000). These results therefore show that the current normal, Xhosa speaking population generally made more errors than the westernised non-litigating normal control groups and some head injured groups included in previous studies on Trail A, while making more mean errors than almost all participant groups on Trail B.

The error score in the 95th percentile (as a higher score indicates a worse performance for this measure, the 95h percentile score was used instead of the 5th percentile score) for Trail A of 1 is much better than the cut-off of $\geq$ 4 errors on either Trail A or Trail B suggested by Ruffolo et al. (2000). In contrast, this error score on Trail B (6.4) falls significantly above the proposed cut-off score. These findings therefore indicate that no adjustments need to be made to these normative indications for Trail A, while a new cut-off score needs to be established for Trail B for the current sample. Converting the 95th percentile score of 6.4 to a whole number for use as an error score, a new cut-off score of $\geq$ 6 is proposed for this population of Xhosa speaking, black participants with a former DET-type education.

4.4.3 The Trail B:A Ratio

Finally, on the measure of the Trail B:A ratio, the participants in this study obtained a mean ratio score of 2.49 (SD=1.24). This score is lower and therefore poorer than that attained by the entire sample of head injured patients included in the study conducted by Iverson et al. (2002) (mean ratio scores ranging from 2.51-3.32), as well as the litigating normal control and litigating cognitively impaired participant groups included in the study by Egeland and Langfjaeran (2007). These findings therefore show that the current normal sample of Xhosa speaking participants with a relatively poor quality of education obtained poorer Trail B:A ratio scores than a sample group comprising of mild-severely head injured patients, who would be expected to perform much worse than a normal functioning group (Iverson et al., 2002).

Additionally, the Trail B:A ratio score falling in the 5th percentile is 1.33. This score falls below the proposed cut-off scores of < 2.5 and ≤ 1.49 used by Egeland and Langfjaeran (2007) and Iverson et al. (2002) in their respective studies. These results therefore suggest that participants from this sample would be classified as malingering if utilising the previous cut-off scores recommended for the Trail B:A ratio. Using the 5th percentile score, a new cut-off score of Trail B:A ≤ 1.33 is therefore proposed here for use on this sample.

A summary of the mean scores, standard deviations, 5th percentile scores, published cut-off scores and cut-off scores from the present study for the five measures from Trail Making Test used in this study is given in Table 22.

Table 22

Summary of Descriptive Statistics and Cut-Off Scores for the Trail Making Test

Measure	Mean	SD	Score in 5th Percentile	Previously suggested Cut-off	Proposed Cut-off For Current Sample
Trail A	39.66	15.93	*74.04	≥ 63[a]	≥ 74
Trail B	90.16	36.13	*174.07	≥ 200[a]	≥ 200
Trail A Errors	0.21	0.42	*1	≥ 4[b]	≥ 4
Trail B Errors	1.3	2.3	*6.4	≥ 4[b]	≥ 6
Trail B:A	2.49	1.24	1.33	≤ 1.49[a] < 2.5[c]	≤1.33

* For these measures a higher score means a poorer performance, so the score was taken from the 95th percentile instead of the 5th percentile

[a]Suggested in Iverson et al. (2002)

[b]Suggested in Ruffolo et al. (2000)

[c]Suggested in Egeland & Langfjaeran (2007)

4.5 Overall Indications from the Study

Overall, the results of this study have shown that test performances falling within one standard deviation of the mean in this sample on at least one measure of all tests used to assess malingering would have been considered as possible malingering, with the exception of the TOMM. The participants obtained high mean scores on both Trial 2 and the retention trial of the TOMM, lending support to all previous studies conducted on this test which have shown that all non-malingering participants without dementia are able to obtain scores ≥ 45, including those who were cognitively impaired or suffered from various illnesses. The results of this study therefore serve to build on the body of literature on this test and show that individuals from a non-western culture with another language as their first language and with a poor quality of education were also able to obtain high scores on this test. This test is less challenging than the other tests utilised in this study. Additionally, it contains two practice examples, regardless of whether the participant completed the first one correctly, whereas the other tests used only contained one sample question or two if

the first question was answered incorrectly. This is consistent with Nell (2000), who suggests in his book on cross-cultural neuropsychology that relatively disadvantaged groups, such as the one used in this study, frequently need additional practice on standard neuropsychological tests than other more advantaged groups. These factors may have therefore made this test more understandable and accessible to the participants from this sample, thus possibly accounting for the differences in performances on this and the other tests used to assess malingering investigated here.

The results of this study show that for all other tests used, and specifically on the measures of items correct in correct location and rows correct in the correct spatial location on the Rey 15-Item Test; ACSS and RDS on the Digit Span subtest of the WAIS-III; and completion time on Trail A, Trail B errors and Trail B:A ratio on the Trail Making Test, current published cut-off scores would incorrectly classify participants obtaining scores in the 5th percentile for this sample as malingering. As a result, it was necessary to make adjustments to existing normative indications, and new cut-off scores were established for the aforementioned measures. The extent of this misclassification possibility is highlighted by the fact that the current sample of black, Xhosa speaking participants with a Grade 11 or 12 education from a former DET school, with no cognitive impairment obtained poorer mean scores than most normal control groups, some groups of head injured patients, patients with various types of cognitive impairment, and groups of simulated and "real-world" probable malingerers on at least one measure of all tests used in this study except for the TOMM. These findings therefore illustrate the manner in which performance is impacted by the factors of culture and/or language, and/or quality of education. As mentioned in the literature review section of this paper, the factors of culture, quality of education, and language are all very closely interconnected (Rosselli & Ardila, 2003; Shuttleworth-Edwards, Donnelly et al., 2004; Shuttleworth-Edwards, Kemp et al., 2004) and it is therefore unclear if any one of them would have more singular impact on performance on these measures than others. Nonetheless, it emphasises the role that the combination of these factors plays in results of neuropsychological tests.

These findings are of particular importance in South Africa, as many black people in this country are affected by all of these factors following the legacy of the Apartheid regime, the effects of which still impact many people in this population group with a low socio-economic status. However, as Shuttleworth-Jordan (1996) notes, this does not mean that well established and tested measures, such as the ones of malingering included in this study, cannot be meaningfully administered to this population. Instead, it emphasises the pressing need for more normative indicators and, in the case of tests assessing malingering, for new cut-off scores, to be established that are appropriate for use on this population group. Furthermore,

the results from this study also stress the importance of making tentative interpretations when using cut-off scores from various neuropsychological tests to detect malingering. As with all previous studies conducted on these tests, the findings from this study additionally highlight the necessity of administering more than one measure of malingering in a test battery (Axelrod et al., 2006; Egeland & Langfjaeran, 2007; Iverson et al., 2002; Larrabee, 2003; Lee et al., 1992; O'Bryant et al., 2003; Ruffolo et al., 2000) and of examining test results alongside qualitative observations, and also taking into consideration the biographical information of the particular individual being assessed.

4.6 Evaluation of the Research

The sample group utilised in this study was stratified for age, first language spoken, level of education, quality of education, area of residence and education, and nationality. This is a strength of this study, ensuring that the findings in relation to this particular population are likely to be robust in spite of a small sample size (N = 33), as it is better to utilise a small, but well-defined sample group than a much larger sample group that is poorly defined (Lezak et al., 2004). However, the results clearly cannot be generalized to other South African people, living in and receiving their education from other areas of this country, speaking a different indigenous South African language, and who are of younger child and adolescent or older adult age groups. The geographical limitation is of particular concern seeing as the quality of education and general conditions at former DET-type schools has been shown to be particularly poor, even when compared to similar types of schools in other provinces (Matomela, 2008). The participants in this study may therefore have yielded poorer results than those who received a DET-type education in other parts of the country.

A second strength of this study relates to the test battery used, which focussed on four of the tests most commonly used to assess malingering. These tests were additionally administered within a larger

neuropsychological test battery containing other standard cognitive tests covering all functional modalities. The testing conditions therefore closely resemble those under which participants applying for financial compensation or other individuals likely to malinger would usually be placed during neuropsychological assessment. However, indications on the four tests used to assess malingering utilised in this study suggest that each test may produce very different findings from one another within the same population, and each test therefore needs research in its own right. The findings of this study therefore are clearly specific to the

tests utilised here and very different results may be attained if using other tests often used to detect malingering.

A final limitation of this study is that it only offers preliminary normative data and proposed cut-off scores on the four tests used to assess malingering included in this study for the current non-clinical sample. It is therefore uncertain how accurately these cut-off scores would be able to differentiate suspected malingerers, simulated malingerers and patients with cognitive impairment from this and other normal participant groups from this particular population.

4.7 Recommendations for Future Research

Taking the above limitations into consideration, the following recommendations are given for future research in order to validate the findings from this study and increase their usefulness for future clinical use:

(i.) More studies are needed which assess a larger sample of black people who have received a former DET-type education from other provinces in South Africa and who speak other indigenous South African languages. This would enable one to assess whether the findings and cut-off scores proposed in the current study can be generalised for use on similar populations in other parts of the country.

(ii.) It would be useful to build on this study by assessing test performances of this population in the Eastern Cape, as well as in other provinces in South Africa, on other commonly used measures of malingering.

(iii.) Further studies are needed which examine the sensitivity and specificity rates of these new cut-off scores in accurately being able to identify malingering and non-malingering groups of

participants. It is therefore suggested that cross validation studies be conducted which apply these newly proposed cut-off scores to groups of litigating and non-litigating head injured patients, people with other forms of cognitive impairment, other suspected malingerers and simulated malingerers belonging to this population group in order to assess the validity of these cut-off scores.

4.8 Final Summary

This study aimed to acquire normative indications using the standard English administration for four commonly employed psychometric test measures used in the detection of malingering., in respect of a sample of Eastern Cape Xhosa-speaking individuals (N = 33) with a Grade 11 or 12 relatively disadvantaged education. Results indicated the need for revised cut-off points in most instances due to consistently poorer performances in this group. These findings thus implicate the need for extreme caution when making assumptions about malingering using data derived from more advantaged, English-speaking populations. The data are in respect of a well stratified sample and represent a clinically useful addition to normative collections specifically for use in respect of this relatively disadvantaged Eastern Cape population. Further research is needed on clinical and malingering populations to ratify the proposed new cut-off points, on populations in other age and language groups within the South African context, and on all tests used to identify malingering prior to their valid use for this purpose.

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Appendices

Appendix A: Biographical Questionnaire

General Information Questionnaire:

Please Note: All information that you write on this report is strictly CONFIDENTIAL and will ONLY be used for the research project. It will NOT be passed onto any employers. Your ANONYMITY will be maintained.

1. Demographic Information

1.1. Name: _____

1.2. Gender: _____

1.3. Age: _____

1.4. Date of Birth: _____

1.5. Place of Birth (City & Country):

_____

1.6. Occupation (Employment at present time):

_____

1.7. E-mail Address: _____

1.8. Contact Number: _____

1.9. First Language: _____

2. Education History

2.1. Name, location and dates of **High School** (s) **(Secondary School)** attended:

1.) Name: _____ **2.) Name:** _____

Location: _____ Location: _____

Dates: _____ Dates: _____

3.) Name: _____ **4.) Name:** _____

Location: _____ Location: _____

Dates: _____ Dates: _____

2.2. **YEAR** that you finished school?_____

2.3. **Highest Level of Education** (Highest Grade Reached):
Tick appropriate level.

Grade 10: _____ Grade 11: _____ Grade 12: _____

2.3.1. If you **TICKED Grade 10** or **Grade 11**, what was the reason you left before completing Grade 12?

_____
_____
_____

2.4. What **symbol** (eg, D, E, F) did you get for **English** at School?

_____

2.5. Did you **fail or repeat** any **grades** at school? _____

2.5.1 If **YES, which grade** and **how many times** did you fail or repeat? _____

3. Socio-Economic Information
Please answer this section **WHEN YOU WERE AT SCHOOL**, not at PRESENT
Please answer YES or No
3.1. When you were still at SCHOOL, did you have:

a: Electricity at home? _____

b: Running water?_____ _____

c: Did you have your own room?_____

d: Did you have at least 2 meals per day? _____

e: Did you have your own toys worth in total over R50? _____

f: What was the attitude of your parents towards your schooling?

Positive, negative or neutral? _____

4. Additional Information

4.1. Have you ever been diagnosed with a **learning problem** (e.g. dyslexia), or received treatment for a learning problem? Please give details.

_____

4.2. Have you ever been admitted to a **psychiatric (mental) hospital** or unit? Please give details.

_____

4.2. Are you currently taking any **medications** (tablets, injection) for a **psychological** or **psychiatric disorder** (mental illness)?
Please give details.

_____
_____

4.3. Have you ever taken any **medications** (tablets, injection) for a **psychological** or **psychiatric disorder** (mental illness) in the **PAST?**
Please give details.

_____
_____

4.4. Do you suffer or have you ever suffered from any **serious illnesses**? Please give details.

_____
_____
_____

4.5. Have you ever suffered any form of **head injury** (eg. hit your head after falling off a bicycle, injured your head in a car accident or during sports)? Please give details, including whether

or not you **lost consciousness** and for **how long** you lost consciousness (minutes or hours).

4.6. Do you know if there were any **complications** (things went wrong) during your mother's **pregnancy** and/or **your birth**? Please give details.

4.7. Do you **drink alcohol** at all? Please give specific details of **how much** you drink and **how often** (eg. 3 beers every day or 8 beers once a week etc.).

4.8. Have you ever used any **drugs** (eg. dagga, mandrax, ecstasy, glue or paint thinners)? Please give specific details of **frequency** (how much) of use and when you **began** using (eg. a packet of dagga every day since you were 15 etc.).

4.9. Is there any other **educational** or **medical** information that you think might have a detrimental (negatively or badly) affect your performance on a cognitive test? Specify.

Appendix B: Pre-Test Screening Questionnaire

Encourage participant to answer as accurately as possible. Tick the option that applies and elaborate when requested. If some questions do not apply to the participant or she/he does not know the answer, record N/A if not applicable, or UK if unknown. Assure participants that information obtained will be kept in the strictest confidence.

Tester: _____

Biographical information

Name:				
Gender:	**M**	**F**		
Age:		**Date of Birth:**		
Handedness:	**Right**	**Left**		
First Language:				
English Proficiency:	**Poor 1**	**Average 2**	**Good 3**	**Excellent 4**
Elaborate:				
Test Date:				

1. General

1.1. Have you had something eat this morning?
- o Yes
- o No

1.2. Have you slept well?
- o Yes
- o No

1.3. Do you wear glasses?
- o Yes
- o No

1.4. Do you experience any problems with your eyes?
- o Yes
- o No

1.5. Do you have a problem with hearing?
- o Yes
- o No

1.6. Have you ever broken an arm?
- o Yes
- o No

1.7. If yes, which one?
- o Right
- o Left

2. Remedial treatment for learning disabilities

2.1. Did you experience any difficulties or problems with learning at school?

- o No
- o Yes

2.1.1 If **YES**, elaborate

_____
_____
_____
_____

2.2. Did you receive any extra help for those problems or difficulties from someone other than your teacher like an Occupational Therapist, Psychologist, Doctor etc?

- o No
- o Yes

2.2.1 If **YES**, elaborate

_____
_____
_____
_____

3. Neurological

3.1. Have you had any head injuries or any other problem that might have effected your brain?

- o No
- o Yes

3.1.1. If **YES,**

(To researcher, if yes, indicate number of previous head injuries sustained by participants and type of head injury. (eg: MVA, fall, assault, gunshot wound etc.)

Pathology Type	**1**	**2**	**3**
Date (month/year)			
Type			
Hospitalized (Yes/No)			
Length of Unconsciousness			
Duration of stay in hospital			

3.2. When you left the hospital, did you have to continue to see the doctor as an outpatient?

- o Yes
- o No

3.3. Are you experiencing any problems related to this injury currently?

- o No
- o Yes

3.3.1. If **YES**, please give further information

_____
_____
_____
_____
_____

4. Education

4.1. What was the last grade you **passed**? (NB, not just started)

- o Grade 10
- o Grade 11
- o Grade 12

4.2. Did you fail or repeat any grades at school?

- o Yes
- o No

4.3. If **YES**, which grade and how many times did you fail or repeat?

- o Once
- o Twice
- o 3 times or more

4.4. What was the reason you failed/repeated?

- o Financial
- o Family responsibilities
- o Lack of interest
- o Political unrest/Strike, School closing
- o Poor academic performance
- o Other

5. Substance Use

5.1. How often do you have a drink containing alcohol?

- o Never
- o Monthly or less
- o Once a week
- o Three times a week
- o Four or more times a week

5.2. How many drinks containing alcohol do you have on a typical day of drinking?

- o 1 or 2
- o 3 or 4
- o 5 or 6
- o 7 to 9
- o 10 or more

5.3. How long have you been drinking in this way?

- o Within the past 6 months
- o From 6 months to 5 years
- o More than 5 years

5.4. How often have you needed a drink in the morning to get yourself going after a heavy drinking session?

- o Never
- o Within the past 6 months
- o From 6 months to 5 years
- o More than 5 years

5.5. Are there financial, legal or family problems related to your drinking?

- o No
- o Yes, but not in the past year
- o Yes, during the past year

5.6. Has a relative, friend, doctor or health worker been concerned about your drinking or suggested you cut down?

- o No
- o Yes, but not in the past year
- o Yes, during the past year

5.6.1. If **YES**, who and what were the reasons for their concerns?

_____

_____

5.7. Have you ever gone to anyone for help about your drinking?

If **YES**, when?

- o Within the past 6 months
- o From 6 months to 5 years
- o More than 5 years

5.7.1. If **YES**, who did you go to?

_____

_____

5.8. Have you ever been admitted to hospital for substance use?

5.8.1. If **YES**, when?

- o Within the past 6 months
- o From 6 months to 5 years
- o More than 5 years

5.8.2 If **YES**, please give more details of the place of admission and the programme etc.:

_____

_____

OPTIONAL (as directed by information contained on questionnaire):

5.9. Have you ever used any **drugs** (eg. dagga, mandrax, ecstasy, glue or paint thinners)? Please give specific details of **frequency** (how much) of use and when you **began** using (eg. a packet of dagga every day since you were 15 etc.).

_____

_____

Appendix C: Informed Consent Form

RHODES UNIVERSITY
DEPARTMENT OF PSYCHOLOGY
PARTICIPANT CONSENT FORM

I, _____ have been informed of the nature of the research in which I will participate. I understand that four intern psychologists from Rhodes University, Karen Anne Hope Andrews, Andrea Jane Wong, Lauren Nicola Fike, and Anita Da Silva Pita will be administering some cognitive tests on me, and I hereby agree to participate in this project.

I understand that:

1) The above-mentioned intern clinical psychologists are conducting research as a requirement for a Masters degree in clinical psychology at Rhodes University. Their aim is to collect scores for a number of cognitive tests for a normal population of black South African people, who speak Xhosa as their first language. These scores will then be used as standard for this population group.

2) The research will involve willing, black, Xhosa speakers with a Grade 11 – 12 education, from a former Department of Education and Training (DET)-type school.

3) Participants will be assessed using various commonly used cognitive tests.

4) Participation in the research is completely voluntary and I have the right to withdraw from the study at any stage.

5) The information collected on individual participants will be strictly confidential, with no personal information being disclosed to anyone, except members of the research team.

6) No individual test results will be given to me or to any other person outside of the research team. The information collected will be used for research purposes only by the researchers and will not be made available to my employers or anyone else under any circumstances.

7) Information collected from this project may be used anonymously for thesis and publication purposes.

_____ _____

Signed (Participant) Signed (Researcher)

_____ _____

Name Name

_____

Date

Appendix D: Test Protocols

TEST OF MEMORY MALINGERING (TOMM) –TRIAL 1 AND TRIAL 2

Name:_____ Clinician:_____ Date:_____

Requirements: TOMM score sheet
TOMM Stimulus booklets
Pencil (for recording)

NOT TIMED

Instructions:
Place the test booklet for Trial 1 in front of examinee. Say:

> "This is a test of your ability to learn and remember pictures of common objects. First, I'll show you 50 pictures, one at a time. Then I'll give you a chance to see how many of them you can remember."

Sample Trial:
Open the test booklet to the page, titled Sample Trial and say:

> "Let's try a sample trial first that contains only two pictures. Look carefully at each picture and try to remember it. You don't have to learn the name of the picture. Just look at each one and try to remember it."

Show each picture for 3 seconds, with a 1-second interval between pictures. Then the clinician turns to the page with 2 pictures (the recognition panel) and says:

> "Point to the picture I showed you before. Was it this one (*clinician points to top picture)* or this one *(clinician points to bottom picture)*?"

If examinee has not responded within 10 seconds, he/she should be encouraged to guess. If either answer is incorrect or examinee seems uncertain about the procedure, the sample trial should be repeated until both answers are correct.

Trial 1:
Turn to the page titled Trial 1 and say:

> "I'm going to show you 50 pictures, one at a time. Look at each one and try to remember it. Do you have any questions before we begin?"

Show each picture for 3 seconds, with a 1-second interval between pictures. Do not speed up or slow down the process on the examinee's request. Also, ensure that the examinee looks at each picture and tap the picture if the examinee does not seem to be paying attention to it. The clinician then turns to the first recognition panel and says:

"Point to the picture I showed you previously."

If examinee has not responded within 10 seconds, he/she should be encouraged to guess. The examinee must give a response for each panel. If the response is correct, the clinician must tell the examinee "correct". *If the response is incorrect, the clinician must say,* "No, that is not right. It was this one," *and point to the correct picture.*

Trial 2:

Place test booklet for Trial 2 in front of examinee and say:

> "I'm going to show you the same 50 pictures again. Look at each one and try to remember it. Any questions?"

Repeat procedure as above for recognition test.

Scoring:

Circle the answer given by the examinee on the TOMM score sheet. The correct answers are in bold and underlined. Once testing has been completed, place a check in the box provided for all correct answers and score each correct answer 1 point.

TEST OF MEMORY MALINGERING (TOMM) RETENTION TRIAL

Name:_____ Clinician:_____ Date:_____

Requirements: TOMM score sheet
TOMM Stimulus booklets
Pencil (for recording)

NOT TIMED

Instructions:
Given after a 15 minute delay after Trial 2. The interval should be filled with non-visual tests. Place the Retention Trial test booklet in front of the examinee and say:

> "Remember the booklet I showed you earlier that contained the 50 pictures? Let's see how many you can remember."

Turn to the first page in the Retention Trial booklet and say:

> "Point to the picture I showed you previously."

Follow the same scoring and administration procedure as for Trials 1 and 2 recognition tests.

REY 15-ITEM MEMORY TEST

Name:_____ Clinician:_____ Date:_____

Requirements: Stimulus card (11,5cm X 9cm)
Blank A4 paper

TIMED **Viewing**

Time Limit: **10 seconds**

Instructions:

"I am going to show you a card with 15 items on it, I will only show you the card for 10 seconds and I want you to try and memorise all 15 items on it."

The idea is to create the impression that the task is difficult:

eg. "There are quite a few items to remember in a short time, but just do your best and see how many you can remember."

Place the memory stimulus card containing the 15 items in front of the subject for 10 seconds. Remove the card and place a blank A4 piece of paper in front of participant and ask them to reproduce the set of characters. If the subject is impulsive or casual during the learning period, they should be encouraged to concentrate on the task.

Observations and impressions made during this test may be very important and must therefore be recorded.

Scoring:

TOTAL NUMBER OF CORRECT ITEMS IN ANY LOCATION = _____

TOTAL NUMBER OF CORRECT ROWS IN CORRECT LOCATION = _____

WAIS-III DIGIT SPAN TEST

Name:_____ Clinician:_____ Date:_____

Requirements: WAIS-III Manual p. 133-135 and 181-193 (or below)
WAIS-III record form (or below)
Pencil

NOT TIMED

Instructions:
DIGITS FORWARD:

"I am going to say some numbers. Listen carefully, and when I am through, I want you to say them right after me. Just say what I say."

Read the digits at the rate of one per second, dropping your voice inflection slightly on the last digit in the sequence.

Discontinue after a score of 0 on both trials of any item.

ITEM NUMBER	TRIAL ITEM	TRIAL SCORE	ITEM SCORE (0, 1, 2)
1.)	*1.* **1-7**		
	2. **6-3**		
2.)	*1.* **5-8-2**		
	2. **6-9-4**		
3.)	*1.* **6-4-3-9**		
	2. **7-2-8-6**		
4.)	*1.* **4-2-7-3-1**		
	2. **7-5-8-3-6**		
5.)	*1.* **6-1-9-4-7-3**		
	2. **3-9-2-4-8-7**		
6.)	*1.* **5-9-1-7-4-2-8**		
	2. **4-1-7-9-3-8-6**		
7.)	*1.* **5-8-1-9-2-6-4-7**		
	2. **3-8-2-9-5-1-7-4**		
8.)	*1.* **2-7-5-8-6-2-5-8-4**		
	2. **7-1-3-9-4-2-5-6-8**		
DIGITS SPAN FORWARDS TOTAL SCORE			

DIGITS BACKWARD:

Administer even if examinee obtains a score of 0 on Digits Forward

"Now I am going to say some more numbers. But this time when I stop, I want you to say them backward. For example, if I say 7-1-9, what would you say?"

If the examinee responds correctly (9-1-7), say: "That's right" *and proceed to trial 1 of item 1.*

If the examinee responds incorrectly, provide the correct response and say, "No, you would say 9-1-7. I said 7-1-9, so to say it backward, you would say 9-1-7. Now try these numbers. Remember, you are to say them backward: 3-4-8."

Do not provide any assistance on this example. Whether or not the examinee responds correctly to this example (8-4-3), proceed to trial 1 of item 1.

Read the digits at the rate of one per second, dropping your voice inflection slightly on the last digit in the sequence.

Discontinue after a score of 0 on both trials of any item.

ITEM NUMBER	TRIAL	TRIAL SCORE	ITEM SCORE (0, 1, 2)
1.)	*1.* **2-4**		
	2. **5-7**		
2.)	*1.* **6-2-9**		
	2. **4-1-5**		
3.)	*1.* **3-2-7-9**		
	2. **4-9-6-8**		
4.)	*1.* **1-5-2-8-6**		
	2. **6-1-8-4-3**		
5.)	*1.* **5-3-9-4-1-8**		
	2. **7-2-4-8-5-6**		
6.)	*1.* **8-1-2-9-3-6-5**		
	2. **4-7-3-9-1-2-8**		
7.)	*1.* **9-4-3-7-6-2-5-8**		
	2. **7-2-8-1-9-6-5-3**		
DIGITS SPAN BACKWARD TOTAL SCORE			

Scoring:

Calculate the digit span raw score by adding up the digit span backwards and forwards scores. You then obtain the age-correlated scaled score (ACSS) by looking up the score for the appropriate age group in the manual. The Reliable Digits Score (RDS) is calculated by adding up the longest digit string recalled correctly on both trials of the item for the digit span forwards and digit span backward.

DIGITS SPAN TOTAL RAW SCORE (FORWARD + BACKWARD SCORES) = _____

AGE CORRELATED SCALED SCORE (ACSS) (FROM MANUAL) = _____

RELIABLE DIGITS SCORE (RDS) = _____

TRAIL MAKING TEST

Name:_____ Clinician:_____ Date:_____

Requirements: Test sheets (4 sheets)
Pencil
Stop watch

TIMED **Time to complete each trail**

Time Limit: **None**

TRAIL A:

Sample:
"Draw a line to connect the circles in order from 1 to 8, without lifting your pencil, as fast as you can."

Test:
Showing the subject the test sheet and pointing out the first 3 or 4 circles which must be joined, give the following instruction:

"Now here is a page with numbers all over it. Draw a line to join the circles in order from 1 to 25, without lifting your pencil. Do it as fast as you can."

Record time taken to join all the circles in the correct order.

TRAIL B:

Sample:
"Draw a line to connect the circles in order, switching from numbers and letters, starting with 1 then A. Do it as fast as you can without lifting your pencil."

Test:
Showing the subject the test sheet and pointing out the first 3 or 4 circles which must be joined, give the following instruction:

"Now here is a page with numbers and letters all over it. Draw a line to join the circles in order by switching between numbers and letters, starting with 1 then A, and finishing with 13. Do it as fast as you can without lifting your pencil."

Record time taken to join all the circles in the correct order.

Note: *If participant makes a mistake, DO NOT STOP TIMING; point out mistake and participant corrects the error and carries on.*

Scoring:

COMPLETION TIME FOR TRAIL A: _____

COMPLETION TIME FOR TRAIL B: _____

ERRORS ON TRAIL A:_____ **ERRORS ON TRAIL B:** _____

TRAIL B:A RATIO SCORE: _____