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**Assessing the robustness of the Test of Premorbid  
Functioning (TOPF) as a measure of premorbid  
intelligence in Alzheimer's and vascular dementia  
and Clinical Research Portfolio**

**Volume I**

(Volume II bound separately)

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Submitted in partial fulfilment of the requirements for the degree of  
Doctorate in Clinical Psychology

Institute of Health and Wellbeing  
College of Medical, Veterinary and Life Sciences  
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## Table of contents

Declaration of Originality	4
Plagiarism Statement	5
Acknowledgements	6
<b>Chapter 1: Systematic Review</b>	<b>7-48</b>
Assessing the validity of reading tests in the assessment of premorbid intelligence in people with a dementia	
<b>Chapter 2: Major Research Project</b>	<b>49-87</b>
Assessing the robustness of the Test of Premorbid Functioning as a measure of premorbid intelligence in Alzheimer's and vascular dementias	
<b>Chapter 3: Advanced Clinical Practice I- Reflective Critical Account</b> (Abstract only)	<b>88</b>
A changing relationship with Cognitive Behavioural Therapy	
<b>Chapter 4: Advanced Clinical Practice II- Reflective Critical Account</b> (Abstract only)	<b>89</b>
From the "Ivory Tower" to the board room: Clinical Psychology as part of the Multi-Disciplinary Team	
<b>Appendices</b>	
Appendix 1.1: Publication 'Instructions for Authors'	<b>90-95</b>
Appendix 1.2: Detailed search strategy	<b>96</b>
Appendix 1.3: Quality rating checklist	<b>97-101</b>
Appendix 1.4: References of excluded studies	<b>102-106</b>
Appendix 1.5: Demographics of included studies	<b>107-112</b>
Appendix 2.1: Publication 'Instructions for Authors'	<b>113-116</b>
Appendix 2.2: Major Research Proposal	<b>117-135</b>
Appendix 2.3: Ethics approval letter	<b>136-140</b>

## Tables and figures

### Chapter 1

<b>Figure 1:</b> Flowchart of systematic search strategy	<b>18</b>
<b>Table 1:</b> Differences between reading test-predicted and obtained IQ scores in healthy participants	<b>24</b>
<b>Table 2:</b> Relationships between reading test-predicted and obtained IQ scores in healthy participants	<b>24</b>
<b>Table 3:</b> Differences between reading test-estimated IQ and other estimators in people with a dementia	<b>26-27</b>
<b>Table 4:</b> Relationships between reading test-estimated IQ and other estimators in people with a dementia	<b>27</b>
<b>Table 5:</b> Comparison between controls and people with a dementia on different IQ estimators	<b>31-32</b>

### Chapter 2

<b>Table 6:</b> Demographic details of participants by group	<b>64</b>
<b>Figure 2:</b> Box plots for IQ scores, by estimator and group	<b>65</b>
<b>Table 7:</b> Descriptive statistics for IQ measures by group	<b>66</b>
<b>Figure 3:</b> Median discrepancy scores between demographic equation IQ and reading test IQ by group	<b>68</b>
<b>Figure 4:</b> Mean and median IQ scores for healthy controls, “less impaired” and “more impaired” dementia groups, by estimator	<b>71</b>
<b>Figure 5:</b> Comparison of reading test-estimated IQ scores and Scorer-estimated IQ scores, by group	<b>73</b>
<b>Figure 6:</b> Scatter plots of the relationships between IQ estimators for each group	<b>74</b>



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# **Chapter 1: Systematic Review**

## **Assessing the validity of reading tests in the assessment of premorbid intelligence for people with a dementia**

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## **Abstract**

**Background:** This review examined the validity of reading tests in estimating premorbid intelligence in people with dementia. The literature is highly contradictory, with some studies suggesting reading ability is well preserved and others documenting changes even in the early stages of dementia.

**Main Objectives:** To establish whether:

- 1) reading tests provide similar estimates of IQ to other estimators in people with a dementia; and
- 2) people with dementia differ significantly from matched controls on reading tests and other estimators of premorbid intelligence.

**Data sources:** Medline, PsychINFO, CINAHL, Scopus and The Cochrane Library were searched and limited to papers written in English and to Adults (18 years+). Search terms included “dement\*”, and “reading test\*”. Titles and abstracts were examined and reference lists of the included studies were checked to identify further papers.

**Study eligibility criteria, participants and interventions:** Eligibility included studies which compared a reading-based test against a VIQ measure and/or a demographic regression equation, in people with a dementia.

**Study appraisal and synthesis methods:** The Strobe checklist was used to rate the methodological quality of the eighteen identified papers, along with an additional checklist of items pertinent to this field. Quantitative results of fourteen papers were compared using effect sizes.

**Results:** Different IQ estimators produce similar estimates in people with mild dementia, and there is no difference between people with mild dementia and healthy individuals on reading tests. However, with increasing severity of dementia, differences begin to emerge.

**Limitations:** The main methodological issues were a lack of reporting of educational levels and dementia severity levels, and differing terms for

dementia severity. Differences in study designs meant effect sizes could not be combined across studies for analysis.

**Conclusions:** Reading tests are a valid estimator of premorbid intelligence in mild or questionable cases of dementia.

**Implications of key findings:** A score of  $\geq 20$  on the MMSE would indicate that a reading test can be used with relative confidence.

**Key words:** dementia, reading test

## **Introduction**

The assessment of dementia and determining whether a person meets a particular set of diagnostic criteria uniformly requires there to be a decline in cognitive functioning. There is wide variability in cognitive performance in the general population, and thus it may prove difficult to compare an individual against group norms and especially so for those who are only mildly impaired. Therefore it may be more relevant to compare an individual's current level of functioning against their previous baseline. Such baselines are rarely available and the clinician must instead rely on methods that estimate premorbid intelligence. Three of the most researched approaches to estimating premorbid ability are reading tests, "hold" versus "don't hold" tests and demographic regression equations.

## **Reading tests**

Reading tests became popular as a premorbid estimator of intelligence with the emergence of research suggesting that reading and intelligence are highly correlated (e.g. Willshire, Kinsella, & Prior, 1991). Such tests assess knowledge obtained prior to the onset of a neurological disease (Nelson & O'Connell, 1978) and which is relatively well preserved compared to other domains such as memory and praxis. Typically these tests are normed against the most recent version of the Wechsler Adult Intelligence Scale (WAIS) to provide estimated Full Scale Intelligence (FSIQ), which can then be compared with obtained (current) IQ scores. A significant discrepancy between predicted and obtained IQ scores indicates cognitive decline.

Various tests have been developed including the National Adult Reading Test

(NART), the Wechsler Test of Adult Reading (WTAR), the reading subtest of various versions of the Wide Range Achievement Test (WRAT, WRAT-R and WRAT-3), the 'Spot the Word' test (STW) and the Schonell Graded Word Reading Test (SGWRT). Full references for all tests in this review are presented in Appendix 1.7.

Most of these tests consist of irregularly-spelled words which the individual is asked to read aloud. The irregular grapheme-to-phoneme translations (such as the "gh" in the word *bough*) in the words make pronunciation difficult if standard spelling rules are applied, and thus previous familiarity is required in order to provide a correct answer.

The current evidence base is highly contradictory with respect to whether reading tests are affected by dementia. Some studies suggest that the NART (e.g. Crawford, Parker & Besson, 1988), STW (e.g. Yuspeh & Vanderploeg, 2000), and the WRAT (e.g. Johnstone, Callahan, Kapila, & Bouman, 1996) perform well in estimating premorbid IQ in people with dementia. The original validation study for the WTAR reported it to be superior to demographic regression equations (Wechsler, 2001) and there is a similar picture for the Test of Premorbid Functioning (TOPF; Wechsler, 2011). Other research suggests the NART (e.g. McFarlane, Welch & Rodgers, 2006), STW (e.g. Law & O'Carroll, 1998) and WTAR (e.g. McFarlane et al., 2006) are affected with increasing severity of dementia.

Some conditions preclude the use of these reading tests such as visual acuity difficulties (e.g. Crawford et al., 1989) and people with language difficulties (e.g. Stebbins, Gilley, Wilson, Bernard & Fox, 1990) or whose first language is not English. Several studies concluded that reading tests are unsuitable for patients with moderate/severe dementias (e.g. Patterson, Graham & Hodges, 1994), suggesting that reading becomes compromised in the later stages of dementia. Additionally, reading tests may systematically underestimate and overestimate IQ for the higher and lower IQ ranges (e.g. Johnstone et al., 1996), respectively. Finally, as healthy individuals show wide variation in their performance across different cognitive domains (e.g. Taylor & Heaton, 2001), it raises doubt as to whether general intellectual functioning can truly be measured by one apparently “spared” cognitive domain.

### **“Hold” versus “don’t hold” tests**

One alternative to reading tests is the comparison of “hold” (e.g. Vocabulary) versus “no-hold” (e.g. Block Design) WAIS subtests, a method based on the premise that some over-learned verbal skills are preserved in the mild to moderate dementias. Different versions of the WAIS utilise different terminology for groups of subtests measuring verbal and perceptual abilities. As most of the studies in this review include older versions of the WAIS, the older terminology of Verbal IQ (VIQ) and Performance IQ (PIQ) will be used.

Given that both reading tests and VIQ subtests measure verbal skills, it is unsurprising that they are generally well correlated (Strauss, Sherman & Spreen, 2006). However, some research purports that reading tests are a better

predictor of intelligence than VIQ subtests (e.g. Sharpe & O'Carroll, 1991) and that even the best "hold" tests are not impervious to the effects of a dementia (e.g. Hart, Smith & Swash, 1986).

### **Demographic regression equations**

Another alternative to reading tests is the use of demographic regression equations, which draw on the well-established relationship between demographic variables and intelligence (Hodges, 2007). Such factors, e.g. age and years of education, are regressed against a measure of current intelligence such as the WAIS (Crawford & Allan, 1997).

Different studies have reported varying degrees of predicted variance. Crawford and Allan (1997) reported that occupation, age and years of education accounted for 53%, 53%, and 32% of the variance in FSIQ, VIQ, and PIQ, respectively. Barona, Reynolds and Chastain (1984) reported that education, race, and occupation were the most powerful predictors of premorbid WAIS-R IQ although their regression equation only accounted for 36%, 38% and 24% of WAIS-R FSIQ, VIQ and PIQ, respectively.

Demographic equations have the advantage of being unaffected by cognitive decline, due to their reliance on static factors, or suboptimal effort on tests.

Nevertheless, self-reported factors such as years of education are open to inaccuracy in the cognitively impaired individual. Eppinger, Craig, Adams and Parsons (1987) noted that one cannot differentiate between an undergraduate and postgraduate degree, nor between mainstream and special education.

Additionally, the degree of error associated with these types of variables is considerable (Basso, Bornstein, Roper & McCoy 2000), and very large confidence interval ranges can result in almost meaningless estimations unless the individual has experienced a very large degree of decline. Furthermore, this approach is also affected by regression to the mean (Basso et al., 2000).

Accuracy is limited in all approaches to estimating IQ, as surmised by Griffin, Mindt, Rankin, Ritchie and Scott (2002) who, in a comparison of methods for predicting IQ, reported reading tests and demographic equations systematically under or over-estimated IQ.

The evidence base for the accuracy of reading tests does not provide the clinician any considerable confidence with respect to whether or not they are a valid tool for this purpose and will be the focus of this review.

### **Aims and objectives**

In order to determine how effective reading tests are in establishing premorbid intelligence in people with a dementia, reading test-estimated IQs will be compared with other IQ estimators, namely demographic regression equations and/or tests which provide a measure of VIQ.

The review objectives were to establish whether:

- 1) there is any difference between a reading test-predicted IQ and obtained IQ scores in people free from neurological disease;

- 2) reading tests provide similar estimates of IQ to other estimators in people with a dementia; and
- 3) people with dementia differ significantly from matched controls on reading tests and other estimators of premorbid intelligence.

## **Method**

### **Search strategy**

The following electronic bibliographic databases were searched between February and May 2015 (final search date 24/05/2015): Medline, PsychINFO, CINAHL, Scopus and The Cochrane Library. The search was limited to papers written in English and to Adults (18 years+).

Databases were searched using various search terms, including: “dement\*”, “pre?morbid intell\*” and “reading test\*” (see Appendix 1.2 for full strategy). Titles and abstracts were examined to identify articles featuring a reading-based test and a comparator (i.e. VIQ and/or a demographic equation). The following journals were hand searched: British Journal of Clinical Psychology and Journal of the International Neuropsychological Society. Reference lists of included studies were checked to identify further relevant papers.

### **Inclusion and exclusion criteria**

The titles and abstracts of papers identified as comparing a reading-based test with another IQ estimator in people with a dementia were screened against the following inclusion and exclusion criteria.



*Inclusion Criteria:*

- Studies comparing the performance of a reading test (in estimating premorbid intelligence) against a measure of VIQ and/or a demographic regression equation; and
- Studies which included a dementia group comprising Alzheimer's, vascular or a mixed presentation dementia (studies may or may not have also had a control group).

*Exclusion Criteria:*

- Studies that were not in English;
- Studies that investigated translated versions of a reading test;
- Studies in which dementia patients were indiscriminately grouped with other neurological/psychiatric disorders (e.g. Parkinson's disease) and results analysed as such;
- Studies that compared only the performance of reading tests;
- Studies which did not specify which reading test was utilised; and
- Studies which developed regression equation(s) to predict premorbid functioning using error scores of reading tests and other factors (e.g. demographic variables).

For papers where it was unclear as to whether they should be included/excluded, discussions were held with the research supervisor to determine this.

## **Assessment of methodological quality**

To rate the methodological quality of the included studies the STROBE checklist (von Elm et al., 2007) was adapted i.e. items were removed from the checklist which were not relevant to this study, such as translating estimates of relative risk into absolute risk. To account for methodological issues pertinent to this review, such as risk of bias if demographic variables were not reported and analysed, an additional checklist was developed (see Appendix 1.3 for a copy of the full checklist). All papers were rated by the author and a second rater assessed 50% of the studies as a means of examining the inter-rater reliability of the checklist; there was 97% agreement and discrepancies were resolved through discussion.

## **Assessment of bias**

The quality checklist credited points to studies for accounting for biases such as appropriate analysis of demographic variables. The quantitative results also considered biases such as methods of classifying disease severity.

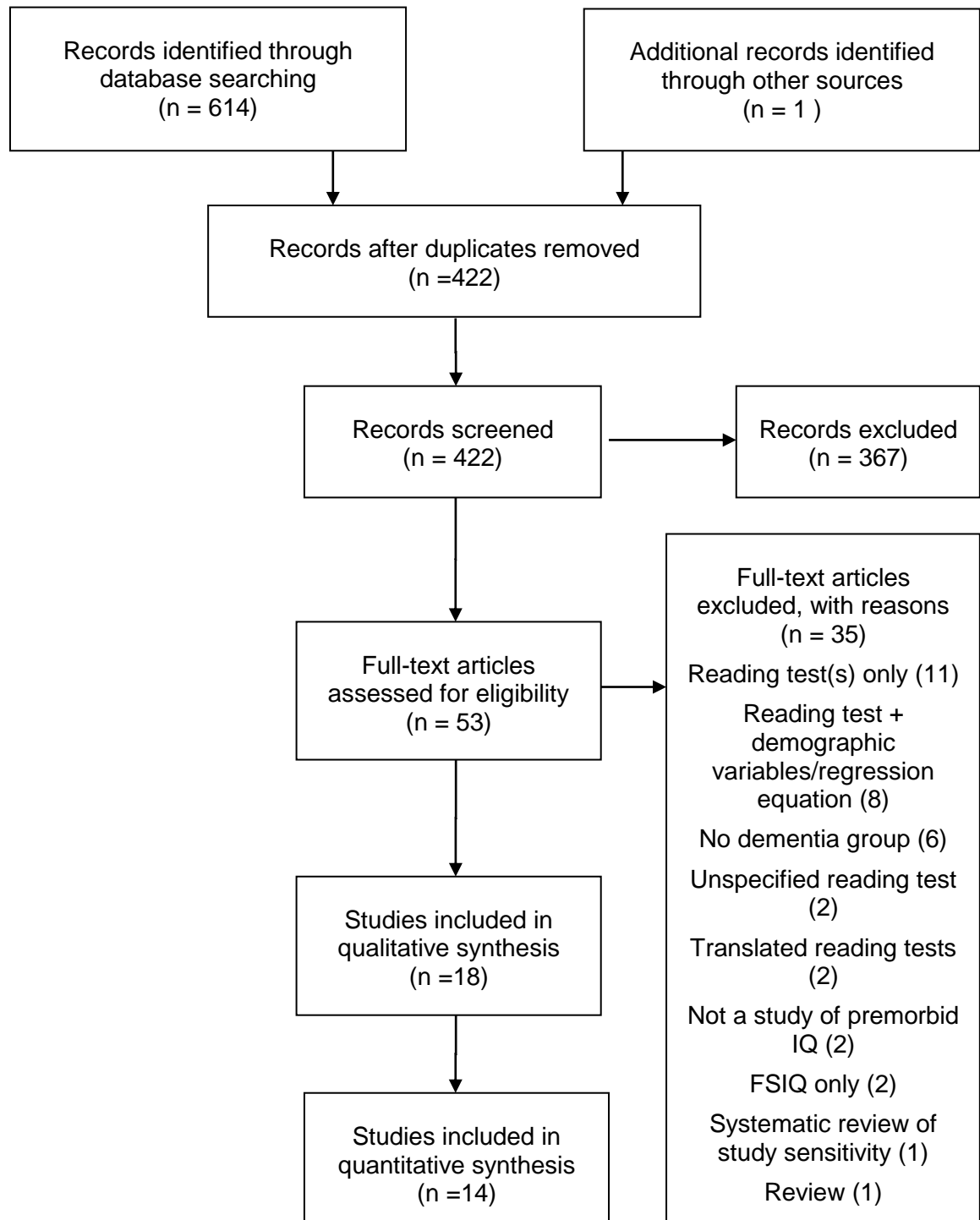
## **Summary measures and synthesis of results**

Summary measures were primarily difference in means (Cohen's  $d$ ). Three studies reported correlation coefficients ( $r$ ) which were considered separately. Effect sizes could not be combined due to differences in study designs.

## **Results**

Figure 1 contains a flow diagram depicting the number of studies included and excluded at each stage of the search. References of included studies are included in the 'References' section and excluded studies are in appendix 1.4.

**Figure 1: Flowchart of systematic search strategy**



Eighteen studies were initially considered as to the assessment of methodological quality, based on the checklist. Fourteen studies were then investigated for differences between IQ estimators and relationships between them; effect sizes could not be calculated for four papers due to insufficient reporting of statistics. Study characteristics and demographic details are presented in Appendix 1.5.

## **Part 1: Quality assessment**

### ***Diagnostic criteria***

Diagnostic accuracy in studies is necessary due to the differing brain pathologies, disease progression and cognitive profiles of the various dementia subtypes. A range of diagnostic guidelines/criteria, laboratory tests, psychometric tests, and functional and structural imaging techniques are available in the diagnosis of dementia.

Ten of the studies in this review used criteria developed by the National Institute of Neurological and Communicative Disorders and Stroke (NINCDS) and the Alzheimer's Disease and Related Disorders Association (ADRDA) (McKhann et al., 1984).

Of the remaining eight studies, two utilised diagnostic manuals (DSM and ICD); three used and specified a range of tests such as scans and psychometric testing; and three did not give details of how a diagnosis was made.

The accuracy of dementia diagnosis in the studies included in this review is high, with only three studies failing to report how a diagnosis was made.

### ***Dementia subtypes***

Eight studies included patients with Alzheimer's disease, five included a "dementia" group (unspecified subtypes), and another five had various subtypes specified. Diagnostic guidelines for differentiating subtypes included guidelines such as the ICD and NINCDS/ADRDA. All of the studies with various subtypes grouped patients together as a heterogeneous 'dementia' group rather than analysing the results separately. Five studies in this review included a dementia group with no specified dementia subtypes.

### ***Severity of dementia***

It is widely accepted that reading ability in dementia is compromised with increasing severity of the disease (Lezac, Howieson, Bigler, & Tranel, 2012) and, as such, one would expect studies investigating reading tests to take account of this.

Seven of the eighteen studies in this review made no attempt to classify level of severity within the "dementia" group. One of the studies cited the use of NINCDS/ADRDA criteria and another used the Dementia Rating Scale (DRS; Mattis, 1988) which Shay et al. (1991) reported was a reasonable estimator of dementia when using a cut-off score of 136; however score ranges for severity levels have not been researched.

Five papers used Mini Mental State Examination (MMSE) cut-off scores to classify severity levels as “mild”, “moderate” and “severe”. Seven studies in this review made no attempt to classify severity and another two (making up half of the studies in total) provided very little information about how severity was categorised. The remaining 50% used instruments which have been researched with regards to categories of severity.

### ***Control groups***

In order to ensure a control group is indeed free from neurodegenerative disease, or other conditions which might impact on testing such as head injury, psychiatric disorder etc, screening should be undertaken. One of the most reliable methods is the use of a validated instrument such as the MMSE. Interviews can also be undertaken to rule out psychiatric or neurological disorders but for an objective and comprehensive screen, a validated tool should be incorporated into the interview (Meyer et al., 2001).

In the ten studies which had a control group, none used both a validated instrument and a clinical interview. 6/10 studies used a screening interview and only 4/10 used a validated screening tool (MMSE or DRS).

### ***Inclusion / exclusion criteria***

Of the ten studies which contained both a patient group and a control group, only two specified inclusion and exclusion for both groups and five studies did not detail any inclusion or exclusion criteria for either group.

Eight studies contained a dementia group only; one specified criteria for the patient group and seven did not detail any criteria.

67% of all studies in this review did not contain any reference to inclusion and exclusion criteria. Thus the reliability and reproducibility of these studies is highly questionable.

### ***Demographic variables***

Demographic variables have a significant association with intelligence and require to be controlled for in studies investigating premorbid intelligence, either through using matched controls or else using appropriate statistical tests.

Five of the eighteen studies used matched controls. All of these matched for age, four also matched for gender and years of education (YoE); two of these four also included occupational status and one also included race. Three of these five studies also performed statistical analysis on demographic variables.

Six studies without matched groups performed statistical analysis on demographic variables. Two of these analysed age, one analysed age and YoE, two analysed age, gender and YoE, and one explored age, gender, YoE and social class.

## **Part 2: Quantitative analysis**

Studies included in the analyses below are in order of methodological strength (see 'References') and statistical significance ( $p$ ) is included when reported.

### **1) Is there any difference between a reading test-predicted IQ and obtained IQ scores in people free from neurological disease?**

Eight studies were included which had a healthy group, a reading test-estimated IQ and an obtained IQ (i.e. WAIS FSIQ or VIQ). Three studies explored the difference between these measures (Table 1), and three studies (Table 2) considered the relationship between them. Where effect sizes could not be calculated, the raw data from these studies is included in Table 1 and marked with \*. Positive effect sizes ( $d$ ) reflect a higher reading test IQ than the comparator and the opposite is true for negative values.

Of the three studies exploring differences, two studies (#3 and #5) found either no effect or only a small difference between predicted and obtained IQ. One study (#10) used two versions of the WRAT and this indicated a moderate difference; however there was no such difference found for the NART.

In visually comparing the raw data from the studies (#8 and #9) where effect sizes could not be calculated, there appeared to be only negligible differences between reading-estimated and WAIS IQs.



**Table 1: Differences between reading test-predicted and obtained IQ scores in healthy participants**

Study #	Reading test(s)	Comparator	(d)
3	NART VIQ	WAIS-R VIQ	-0.06
	NART FSIQ	WAIS-R FSIQ	-0.32
5	NART FSIQ	WAIS FSIQ	0.02
		WAIS VIQ	0.04
		WAIS Vocab	0.15
8*	NART FSIQ (mean 106.5)	WAIS Vocab (mean 106.7)	
9*	NART FSIQ (mean 108.8)	WAIS FSIQ (mean 109.4)	
	NART-R FSIQ (mean 102.5)	WAIS-R FSIQ (mean 101.8)	
10	NART-R	WAIS-R	-0.14
	WRAT-R		-0.45
	WRAT-3		-0.53

**Table key:** NART(-R) = National Adult Reading Test(-Revised); WRAT(-R;-3) = Wide Range Achievement Test(-Revised; -3<sup>rd</sup> Edition); FSIQ = Full Scale intelligence; VIQ = verbal intelligence; WAIS(-R) = Wechsler Adult Intelligence Scale(-Revised); WAIS Vocab = WAIS vocabulary subtest

**Table 2: Relationships between reading test-predicted and obtained IQ scores in healthy participants**

Study #	Reading test(s)	Comparator	(r)	(p)
2	MHT	NART	.62	
17	SGWRT	WAIS FSIQ	.74	
18	SGWRT	WAIS FSIQ	.75	< .001
		VIQ	.78	< .001
		WAIS Vocab	.79	< .001

**Table key:** MHT = Moray House Test; SGWRT = Schonell Graded Word Reading Test; NART = National Adult Reading Test; WAIS = Wechsler Adult Intelligence Scale; FSIQ = full scale intelligence; VIQ = verbal intelligence; WAIS Vocab = WAIS vocabulary subtest

All three studies in Table 2 found a strong positive association between reading test scores and obtained IQ scores in healthy participants.

Overall, it seems that there are no significant differences between reading test-predicted IQ and obtained IQ scores in people free from neurological disease, and there is a strong positive correlation between the two.

## **2) Do reading tests provide similar estimates of IQ to other estimators in people with a dementia?**

Eleven studies were included for analysis; eight explore differences between reading tests and another method of estimating premorbid IQ (Table 3), and three investigated the relationship between these measures (Table 4). Positive effect sizes ( $d$ ) reflect a higher reading test-estimated IQ than the comparator and the opposite is true for negative values. Effect sizes could not be calculated for seven studies. Five of these (studies marked with \*) have been included in Table 3, and the test results included. The remaining two (#17 and #18) did not report results which could be interpreted.

### *Reading tests vs. VIQ*

In studies investigating differences between reading tests and a measure of VIQ, reading tests provided a higher IQ estimate, with nearly all of the studies finding a large effect size. Most of these studies did not classify severity of dementia; the one that did (#3) reported a higher reading test IQ for both mild and moderate dementia groups.

Three studies explored the strength of association between the NART and a measure of VIQ (Moray House Test; MHT and Mill Hill Vocabulary Scale; MHVS); two of these (#2 and #15) found a large association and the final one (#12), a follow up study a year later (to #15), found a medium relationship. Both

of the dementia groups in the former two studies were reportedly mild-moderate severity; it is likely that a year later (#12) the participants had deteriorated and we might expect this to affect the relationship between the measures.

**Table 3: Differences between reading test-estimated IQ and other estimators in people with a dementia**

Study #	Reading test(s)	Comparator	Groups	<i>p</i>	( <i>d</i> )
				(mean group IQ scores)	
1*	NART(-)	Demo Equation	Minimal AD	.96	
			Mild AD	.042	
	CCRT(-)		Minimal AD	.78	
			Mild AD	.38	
3	NART	VIQ	Mild AD		1.67
			Mod AD		1.58
		Demo Equation	Mild AD		0.12
			Mod AD		-0.61
4*	NART		Minimal AD	(mean 107.0)	
			Mild AD	(mean 101.5)	
			Mod AD	(mean 92.4)	
			Minimal AD	(mean 104.4)	
			Mild AD	(mean 107.7)	
			Mod AD	(mean 106.2)	
5	NART	VIQ	AD	<.01	1.77
		WAIS Vocab		<.05	0.86
	SGWRT	VIQ		<.01	1.23
		WAIS Vocab			0.25
6*	NART		V. Mild dementia	(mean 108.7)	
			Mild dementia	(mean 104.5)	
			Mod/Sev dementia	(mean 99.1)	
			V. Mild dementia	(mean 115.0)	
			Mild dementia	(mean 114.7)	
			Mod/Sev dementia	(mean 113.5)	
7*	NART		Mild AD	(mean 106)	
			Mod AD	(mean 101)	
			Sev AD	(mean 99)	
			Mild AD	(mean 47.7)	
			Mod AD	(mean 40.6)	
			Sev AD	(mean 31.1)	

8*	NART	WAIS Vocab	AD	(mean NART = 104.0, mean Vocab = 97.3) (sig.)	
			VD	(mean NART = 97.8, mean Vocab = 102.0) (n.s.)	
9	NART	Demo Equation	AD	<.01	-1.12
	NART-R	Demo Equation-R		<.05	-1.04
10	WRAT-R	Demo Equation	Mild AD Mod AD		-0.23 -0.77
	WRAT-3		Mild AD Mod AD		-0.17 -0.64
	NART-R		Mild AD Mod AD		0.23 -0.38
11	NART	Demo Equation	Dementia (No Language issue)		-1.25
			Dementia (naming or fluency issue)		-1.07
			Dementia (naming and fluency issue)		-1.86
13	NART Time 1	VIQ Time 1	Dementia (total group)	<.000	0.71
	NART Time 2	VIQ Time 2		<.000	0.97
	NART Time 1	VIQ Time 1	Dementia (subgroup of total)	(n.s.)	(0.25)
	NART Time 3	VIQ Time 3		<.002	0.95
14	WRAT-R	VIQ	AD		0.22
	NAART				0.49
16	NART	Demo Equation	Dementia		-0.63

**Table key:** NART(-R) = National Adult Reading Test(-Revised); NAART = North America Adult Reading Test; WRAT(-R;-3) = Wide Range Achievement Test(-Revised; 3<sup>rd</sup> edition); SGWRT – Schonell Graded Word Reading Test; Demo Equation(-R) = demographic regression equation(-Revised); WAIS Vocab = Wechsler Adult Intelligence Scale vocabulary test; VIQ = verbal intelligence; AD = Alzheimer's disease; Mod = moderate; (sig.) = significant result; (n.s.) = not significant result

**Table 4: Relationships between reading test-estimated IQ and other estimators in people with a dementia**

Study #	Reading test(s)	Comparator	Groups	<i>p</i>	( <i>r</i> )
2	NART	MHT	AD		0.63
12	NART	MHVS	Dementia	(n.s.)	0.30
15	NART	MHVS	Dementia	<.01	0.69

**Table key:** NART = National Adult Reading Test; MHT = Moray House Test; MHVS = Mill Hill Vocabulary Scale; AD = Alzheimer's disease; (n.s.) = not significant

Study #2 obtained the MHT scores when the cohort of participants were children and this study lends significant support for the NART as a premorbid estimator of intelligence, as the strength of the relationship was strong for these participants who as adults had a mild/moderate dementia.

### *Reading tests vs. demographic regression equations*

The results of this analysis are considered in terms of papers that categorised dementia into severity levels and those which did not (see Appendix 1.5). The two papers (#9 and #16) which did not categorise severity levels reported a higher demographic regression equation-estimated IQ and the effect sizes were medium to large.

Of the three studies which did classify severity, two (#3 and #10) found no difference between reading and demographic IQ estimates in people with a “mild” dementia (MMSE score 20-25; DRS score 110-130), and one (#11) found a large difference (MMSE 16-23). This latter study, however, did not report the educational level of the participants and the MMSE score would suggest they were more impaired than participants in the other studies. Studies #3 and #10 included a “moderate” severity dementia group and both found a medium to large difference between reading and demographic IQ estimates.

For the five studies where effect sizes could not be calculated, significant differences between reading and demographic IQ scores were reported for three studies with a “mild” dementia group (MMSE scores 14-23, 14-23 and 16-

23); two of which also reported a difference in a “moderate” dementia group (MMSE scores 2-13 and 5-15); and one of which found no difference for a “minimal” group (MMSE 24-28). The final study did not categorise severity but reported a difference between the two estimators in people with a dementia.

The results suggest that reading tests and demographic equations provide similar results for people with a “mild” dementia but the question of what constitutes a “mild” dementia is problematic. Reading tests provide a higher estimate of IQ compared to measures of VIQ, although in “mild” dementias there is a positive correlation between the two. Significant differences begin to emerge on all measures for people with increasing severity of dementia. Many studies did not categorise severity levels and thus their results are difficult to interpret. The issue of severity is considered further in this review.

### **3) Do people with dementia differ significantly from matched controls on reading tests and other estimators of premorbid intelligence?**

This question was investigated using seven studies which had a control and dementia group and the results are presented in Table 5. The raw data of two studies (\*) was included for visual inspection purposes. Information is also given on whether the control groups were matched or statistical analysis revealed any differences between them and people with a dementia. Where control groups were matched to patients, this is indicated by (M). Positive effect sizes ( $d$ ) reflect a higher IQ for controls than for people with a dementia and the opposite is true for negative values. Although many more studies will have explicitly investigated the use of VIQ measures and demographic equations in estimating

premorbid IQ, these measures have been included from the studies in this review to act as a comparator against reading tests.

### *Reading tests*

Studies #1, #3 and #10 (all matched on age and years of education) found differing effect sizes for their minimal, mild and moderate dementia groups. Studies #1 and #10 utilised similar score ranges on the MMSE but labelled them differently (see Appendix 1.5). If we therefore compare the studies on MMSE scores 14-19 and 14-23, both found a medium-large effect size between matched controls and dementia groups; and for MMSE scores 24-28 and 20-25 both found no difference or only a small difference. The “moderate” group (DRS<110) in study #3 also found a large effect size between groups and only a small effect size for the “mild” group (DRS 110-130).

Furthermore, study #2, which compared the NART against an actual obtained IQ from childhood, reported a non-significant effect between mild/moderate dementia and healthy controls, when the scores were adjusted for the MHT score (due to there being differences between the groups in terms of childhood ability). This study also analysed results for people ( $n = 14$ ) with an MMSE score of <21 and the correlation for MHT-NART was a medium/strong relationship of 0.71.

**Table 5: Comparison between controls and people with a dementia on different IQ estimators**

Study #	Reading test(s)	VIQ or Demo Equation	Groups	Matched?	<i>p</i>	( <i>d</i> )	
					(mean group IQ scores)		
1	NART		C vs. Mild AD	(M)	<.05	-0.87	
	CCRT				<.05	-0.59	
	WTAR				<.05	-0.54	
	STW				>.05	(-0.28)	
	NART		C vs. Minimal AD		<.05	-0.07	
	CCRT				>.05	(-0.06)	
	WTAR				>.05	(-0.09)	
	STW				>.05	(0.01)	
2	NART	<i>MHT</i>	C vs. dementia	No diff in age	<.001	0.67	
		<i>MHT(Adj.)</i>			.12 (n.s.)	(0.27)	
3	NART		C vs. Mild AD	(M)	C vs. AD <.005	0.27	
			C vs. Mod AD			1.11	
		VIQ	C vs. Mild AD		C vs. AD <.005	1.86	
			C vs. Mod AD			2.75	
		Demo Equation	C vs. Mild AD		C vs. AD >.005	(0.41)	
			C vs. Mod AD			(0.54)	
5	NART		C vs. AD	Comparable on social class & occupation	<.05	0.79	
					VIQ	<.001	1.72
					WAIS Vocab	<.01	1.04
6*	NART		C	Controls selected to match patient groups on Demo – estimated IQs	(mean 111.0)		
			V. Mild dementia		(mean 108.7)		
			Mild dementia		(mean 104.5)		
			Mod/Sev dementia		(mean 99.1)		
		Demo Equation	C		(mean 114.9)		
			V. Mild dementia		(mean 115.0)		
			Mild dementia		(mean 114.7)		
			Mod/Sev dementia		(mean 113.5)		



9*	NART		C vs. AD	(M)	(mean C = 106.1, mean AD = 104.0) (n.s.)	
			C vs. VD		(mean C = 97.8, mean VD = 103.0) (n.s.)	
		WAIS Vocab	C vs. AD		(mean C = 107.0, mean AD = 97.3) (sig.)	
			C vs. VD		(mean C = 107.0, mean VD = 102.0) (sig.)	
10	WRAT-R		C vs. Mild AD	No difference in age or education		0.13
			C vs. Mod AD			0.45
	WRAT-3		C vs. Mild AD			-0.01
			C vs. Mod AD			0.25
	NART-R		C vs. Mild AD			0.17
			C vs. Mod AD			0.59
		Demo Equation	C vs. Mild AD			0.36
			C vs. Mod AD			0.22
17	SGWRT		C vs. dementia	Not considered		0.13
		VIQ				1.57
18	SGRWT		C vs. dementia	No difference in age	(n.s.)	(-0.01)
		VIQ			<.001	1.08
		WAIS Vocab			<.01	0.57

**Table key:** NART(-R) = National Adult Reading Test(-Revised); CCRT = Cambridge Contextual Reading Test; WTAR = Wechsler Test of Adult Reading; STW = Spot the Word test; SGWRT = Schonell Graded Word Reading Test; WRAT(-R;-3) = Wide Range Achievement Test(-Revised; 3<sup>rd</sup> edition); MHT(-Adj.) = Moray House Test(-adjusted scores); Demo Equation = demographic regression equation; WAIS = Wechsler Adult Intelligence Scale; VIQ = verbal intelligence; WAIS vocab = WAIS vocabulary subtest; AD = Alzheimer's disease; Mod = moderate; (M) = matched groups; (n.s.) = not significant

Study #5 found a large difference between controls and patients on the NART and which recorded severity level to be mild-moderate based on Blessed, Tomlinson and Roth's (1968) 37-item test; however there was no information on the comparability of the two groups on age, years of education or gender. Two studies (#17 and #18) found no difference between healthy controls and people

with a dementia on the SGWRT, however one did not consider any differences in demographic characteristics of the group and the other only considered age. Furthermore, severity levels were not reported.

Overall, there appears to be no significant difference between “mild” dementia and controls on reading-test estimated IQs, when “mild” is categorised as a score of  $\geq 20$  on the MMSE. Although the study (#2) which included an actual IQ score suggested that the NART is still valid in people with an MMSE score of  $< 21$ , this was based on a small sample and other studies suggest that significant differences begin to emerge.

#### VIQ

All studies in the analysis found a difference on measures of VIQ between controls and people with a dementia, with effect sizes ranging from medium to large. Only study #3 had a matched control group, one (#17) made no consideration of demographic variables, and the rest reported some demographic variables. It would appear that VIQ is affected by dementia.

## **Discussion**

Much of the research on reading tests as an estimator of IQ has focused on how well such tests work in people with a dementia, and whether such tests hold in the face of increasing dementia severity. In practice, individuals with more moderate and severe dementias rarely require formal neuropsychological assessment, as evidence of cognitive decline is more acutely apparent. For individuals with a mild or questionable dementia, neuropsychological assessment is recommended by NICE (2006). Generally, however, the evidence for the validity of reading tests in the assessment of dementia has been conflicting and is the subject of this review.

In considering the results of this review, it is important to be cognisant of the age of the papers included, with fourteen of the eighteen studies at least fifteen years old. Reporting standards have changed considerably and thus whilst it may be necessary to be cautious when interpreting the results of some studies, it is not to suggest they are methodologically unsound; instead it is noted that they did not report certain information. The main methodological issues affecting the review were a lack of reporting of educational levels and dementia severity levels, lack of dementia subtype classification, and differing terms for dementia severity.

The issue of severity is important because if some of the studies included in this review recruited people with a moderate-severe dementia, we would expect a decline in reading score. Education also impacts on reading ability and some research tentatively suggests that people who develop a dementia have lower levels of intellectual functioning and levels of education. Whalley, Starr,

Athawes, Hunter, Pattie and Deary (2000) examined data from the 1932 Scottish birth cohort (where children were given IQ tests aged 11). They concluded that mental ability scores were significantly lower in children who developed a dementia as older adults compared with those who did not.

As education and severity both impact on reading ability, the results of some studies in this review should be interpreted cautiously.

With regards to classifying dementia subtypes, research in differentiating cognitive profiles of Alzheimer's and vascular dementia has evidenced that oral word reading ability is comparable between the two (e.g. Vuorinen, Laine & Rinne, 2000) and a recent systematic review by Mathias and Burke (2009) reported that none of the tests of verbal ability (including WAIS subtests and reading), or general intellectual functioning (FSIQ, VIQ or PIQ) discriminated Alzheimer's from vascular dementia. The indistinct cognitive profiles of these two diseases suggest it is not essential to analyse results by diagnostic categories of these two dementias in particular.

Some studies, however, included a dementia group with no specified dementia subtypes. This is problematic as subtypes other than Alzheimer's and vascular dementia may have different cognitive profiles which may impact on the results. For example, in a systematic review of Alzheimer's and frontotemporal dementia, Hutchinson and Mathias (2007) reported differences between the subtypes on VIQ scores, WAIS subtests, and a large difference on the MMSE, which suggests that some dementia subtypes should be analysed separately.

The quality of reporting and methodological issues highlighted suggest that further research is required in this field in order to provide up-to-date and robust evidence regarding the validity of reading tests in estimating premorbid intelligence in people with a dementia. The conclusions of the analyses in this review are based on the available evidence to date and are detailed below.

In people free from neurological disease, reading tests are a generally good predictor of IQ. Of particular interest is the study comparing a MHT score obtained when the participants were aged 11 and a NART score obtained from the same participants in adulthood. This study reported a medium strength association between the two measures, suggesting the NART is a good predictor of IQ. This result is perhaps unsurprising, given that the MHT is a measure of verbal ability as is the NART. Nevertheless, the findings of this study are also supported by most of the other studies suggesting no difference (or only a small difference) between reading tests and current measures of IQ in healthy individuals.

In people with a “mild” dementia, there appears to be little difference between the different methods in IQ estimation. As dementia severity increases, VIQ-estimated IQs are lower than reading test equivalents, and reading tests provide lower IQ estimates than demographic equations. We would expect there to be a difference for more impaired individuals between reading test IQs and demographically-based IQs, as reading ability becomes compromised with increasing severity; however it appears VIQ measures are the least robust measure in assessing IQ in people with moderate/severe dementias.

One significant finding from this review is the problematic use of terms such as “mild” and “moderate”, even when utilising a validated tool for the purposes of classifying severity. The MMSE is one tool often used to make this distinction. Various researchers (e.g. Patterson et al., 1994) have explored MMSE score ranges for severity levels, resulting in different category boundaries being reported. Therefore, the terms “mild”, “moderate” and “severe” are not easily comparable across studies as, for example, in one study scores between 14 and 19 constituted a “moderate” severity whilst in another study scores between 14 and 23 represented a “mild” severity. Furthermore, these category boundaries are problematic as more recent research has suggested that the MMSE is highly susceptible to the effects of education, age and socioeconomic status (Hodges, 2007). Although these issues mean categorising dementia severity level is challenging, there is still value in attempting to do this, as score ranges on validated tools enable a comparison of the dementia severity levels of participants in different studies.

It may be more meaningful to consider when it may be appropriate to use reading tests based on a cut-off score on the MMSE, which this review would suggest  $\geq 20$ . Although the study with an actual IQ obtained from childhood suggested that even below a score of 21 the NART was still a valid tool, other studies suggest that compromised reading ability means reading tests provide lower estimates of IQ. Demographic equations provide a higher IQ estimation and therefore may be a more accurate estimate, providing caution is exercised for individuals at the higher and lower end of the ability scale.

In conclusion, reading tests are a valid estimator of premorbid intelligence in people with a dementia, whose scores are  $\geq 20$  on the MMSE.

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## References of included studies

Study numbers (#) refer to methodological strength (see Appendix 1.5).

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## **Chapter 2: Major Research Project**

### **Assessing the robustness of the Test of Premorbid Functioning as a measure of premorbid intelligence in Alzheimer's and vascular dementia**

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## **PLAIN ENGLISH SUMMARY**

### **Introduction**

The early detection of a dementia, such as Alzheimer's or vascular dementia, is becoming increasingly important as advances are made in terms of medication and therapy, and research suggests that early intervention may be beneficial (The National Audit Office, 2007). For people with a mild or questionable dementia, it is recommended that they have access to cognitive testing as part of a wider assessment (NICE, 2006, p.21).

Cognitive testing aims to identify whether there has been a deterioration in a person's general level of functioning. To do this, a Psychologist will try to determine how well an individual was functioning before a dementia began (their "premorbid" functioning) and then compare this with tests which assess the person's current level of functioning. If there is a difference between these, this may indicate the presence of a dementia.

To estimate premorbid functioning, Psychologists can use a reading test or a mathematical equation which calculates a person's age, level of education (etc). Reading ability is not thought to be affected by a dementia until the disease becomes more severe.

### **Aims and objectives**

A new reading test to estimate premorbid functioning, called the "Test of Premorbid Functioning" (TOPF), was released in 2011 and as yet there have been no independent studies exploring how well this estimates premorbid

functioning in people with a dementia. This was the aim of the current study. In order to achieve this, the TOPF was compared with a different reading test (Spot-the-Word 2; STW-2) and a mathematical equation (as described above). The main questions to answer were:

- 1) Does the TOPF provide a similar estimate of premorbid functioning for people with a dementia compared to people without a dementia?
- 2) How well does the TOPF compare with the STW-2 and the mathematical equation in estimating premorbid functioning in people with a dementia?

### **Methods and participants**

Thirty people with a diagnosis of dementia (Alzheimer's, vascular or both) and their partners (who did not have a dementia) were recruited from two NHS clinics. The partners were recruited to provide a comparison against people with a dementia, and were similar in age and socioeconomic status. All participants were tested on the TOPF, STW-2 and details were recorded for the mathematical equation (e.g. years of education).

### **Results**

- 1) From this study, it appears the TOPF under-estimated premorbid functioning in people with a dementia, although it was a relatively small under-estimation.
- 2) The TOPF and STW-2 provided similar estimates of premorbid functioning in people with a dementia, and both were an underestimation. The mathematical equation provided a higher estimate of functioning than the reading tests.

## **Conclusion**

This study found that the TOPF under-estimated premorbid functioning in people with a dementia compared with healthy individuals, although this was a small under-estimation. Other studies have reported some similar results. Limitations of the study included a modest sample size and the mathematical equation used was an old equation and may not be directly comparable with the reading tests (it may have over-estimated premorbid functioning). Future research could include a similar larger scale study. If Psychologists continue to use the TOPF, they should interpret the results cautiously and use other tests as well as information from the patient.

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## **Abstract**

**Introduction:** The Test of Premorbid Functioning (TOPF) is a relatively new reading test designed to estimate premorbid intelligence in people with a diagnosed or suspected dementia. A discrepancy between premorbid and current functioning is indicative of cognitive decline. Previous studies have reported mixed results on the validity of reading tests in people with dementia, and the TOPF has yet to be investigated as to how well it holds in dementia.

**Objectives:** To assess the robustness of the TOPF against the Spot-the-Word (version 2; STW-2) and a demographic regression equation in estimating premorbid ability in people with Alzheimer's disease (AD), vascular dementia (VD) and mixed dementias (AVD).

**Design:** A cross-sectional study with two groups of participants assessed on three measures of premorbid ability.

**Methods:** Thirty patients with an ICD-10 diagnosis of probable AD, VD or ADV were recruited from two NHS Older Adult Community Mental Health teams and their scores on the TOPF, STW-2 and a demographic equation were compared with thirty healthy matched controls.

**Results:** Significant between-group differences were found for both the TOPF and STW-2, with an average difference of 5-7 IQ points and a medium effect size. The results suggest that both reading tests systematically under-estimated premorbid IQ in the dementia group. The demographic equation provided a significantly higher estimation of IQ than both of the reading tests for people with a dementia. When the dementia group was arbitrarily split into a "less impaired" and "more impaired" group, based on the median ACE-III score of 65, there was still a medium effect size between the healthy controls and the dementia groups on the TOPF and STW-2.

**Conclusion:** The findings of this study suggest that the TOPF underestimates premorbid IQ in people with a dementia. Clinicians should exercise caution when interpreting the results of reading tests by considering and reporting the confidence intervals for obtained-minus-predicted IQ discrepancies and with

clear reference to the clinical history and other cognitive test results. These findings are discussed with respect to the literature on the validity of reading tests and recommendations for future research are provided. Limitations of the study included a modest sample size and the use of a demographic equation which has not been normed against the current WAIS-IV.

**Practitioner points:**

- 1) The TOPF and STW-2 provide similar estimates of premorbid IQ in people with a dementia.
- 2) Both reading tests systematically underestimated premorbid ability in people with a dementia, by between 5 and 7 IQ points.
- 3) When using reading tests to determine an obtained-minus-predicted discrepancy score, confidence intervals should be considered and reported in the analysis and there should be clear reference to the clinical history and other cognitive test results.
- 4) This study was based on a modest sample size and utilised a demographic equation which has not been normed against the current WAIS-IV.

## **Introduction**

The early detection of a neurodegenerative disease, such as Alzheimer's, is becoming increasingly important as advances are made in pharmacological and psychological treatments and research suggests that early intervention may be beneficial (The National Audit Office, 2007). Alzheimer's disease is the most common type of dementia, with the National Audit Office estimating that 62% of diagnosed dementias are of the Alzheimer's type, with vascular dementias accounting for around 30%.

NICE (2006) states that an assessment of a person with suspected dementia should be comprehensive and include history taking, a medication review and cognitive, physical and mental examination; and that "formal neuropsychological testing should form part of the assessment in cases of mild or questionable dementia" (p.21).

Estimation of premorbid intelligence is a well established and crucial component of neuropsychological assessment, due to the need to establish a baseline from which to identify any cognitive decline. Currently, the three main approaches to estimating premorbid intelligence are demographic-based regression equations, lexical decision-making tasks and reading ability.

Reading tasks have become popular in clinical practice and utilise vocabulary level as a correlate to intelligence (IQ). Such tests rely on the resistance of reading ability to cognitive impairment associated with early stages of most neurodegenerative conditions.

The participant is presented with irregularly spelled words and prompted to pronounce each one. The irregular grapheme-to-phoneme translations (such as



the “gh” in the word *rough*) in the words make it difficult to pronounce without previous familiarity. Since participants cannot apply standard pronunciation rules to complete the task, their vocabulary can be assessed by their ability to pronounce the irregularly spelled words, and by extension, estimate their premorbid IQ. However, reading tests are not impervious to the effects of degenerative disease and several studies (e.g. Cockburn, Keene, Hope & Smith, 2000) have demonstrated that reading ability becomes compromised with increasing dementia severity.

Lexical decision tasks measure the ability to classify stimuli (a string of letters) as words or non-words. The “Spot The Word” test (Baddeley, Emslie, & Nimmo, 1992) is one such task which research (e.g. Yuspeh & Vanderploeg, 2000) suggests is resistant to cognitive impairment and thus provides a useful alternative to reading tests for estimating premorbid intellectual functioning. However, this test also appears to significantly decrease in accuracy with moderate to severe dementias (e.g. Law & O’Carroll, 1998). There is now a second version of this test (STW-2; Baddeley & Crawford, 2012) in which participants are presented with pairs of words, one of which is real and the other a nonsense word. Participants select the real word from the pair and there is no requirement for the word to be pronounced. This task allows decisions to be made through multiple methods including; meaning, familiarity, appearance and sound of words and participants are not penalised for incorrect pronunciation.

Demographic regression equations employ an actuarial approach to the estimation of premorbid ability, using known relationships between demographic variables and performance on intelligence testing. Variables such as age, education and occupation are entered into a regression formula to yield a

predicted "IQ" score. One advantage of utilising this method is that an estimate is obtained without the need for testing and is independent of the person's current cognitive functioning, thus remaining constant throughout an individual's lifespan. However, some studies (e.g. Rentz et al., 2004) have demonstrated indices such as education are not always the most accurate estimation of IQ, perhaps as they do not account for intellectual development that may continue throughout life. There are also concerns regarding the accuracy of self-reporting.

Accuracy is limited in all approaches, as shown by Griffin, Mindt, Rankin, Ritchie, and Scott (2002) who, in a comparison of methods for predicting IQ, reported that reading tests and demographic equations systematically under or over-estimated IQ. These limitations pose significant challenges for clinicians who require accurate estimations in order to assess the extent of cognitive decline in patients with a dementia. Research in this area continues in order to equip clinicians with the best available evidence regarding the relative strengths and weaknesses of individual and combined approaches and regarding new tests available.

Although reading ability has been demonstrated to be preserved in the early stages of dementia (e.g. McGurn et al., 2004), McFarlane, Welch and Rodgers (2006) found a demographic estimation (based on a regression equation) and a lexical decision-making task ("Spot the Word" test) provided a higher estimate than the National Adult Reading Test (NART) for participants with mild Alzheimer's disease. The study also found that the Wechsler Test of Adult Reading (WTAR; Wechsler, 2001) was more robust than the NART, however it did underestimate IQ in participants with mild Alzheimer's.

The Test of Premorbid Functioning (TOPF) was developed by Wechsler in 2011 and is an updated version of the WTAR. The TOPF is standardised with the Wechsler Adult Intelligence Scale Fourth Edition (WAIS-IV; Wechsler, 2008). As the TOPF is a relatively new test there has yet to be any study conducted to assess its performance as a reading test against the other forms of estimating premorbid intelligence levels.

### **Aims and hypotheses**

The principle aim of this study is to provide a follow-up to McFarlane et al.'s (2006) study, exploring the robustness of the relatively new TOPF against another reading-based test (Spot the Word version 2; STW-2) and a demographic estimate (based on a regression equation). The TOPF is the primary focus of this study as it is currently the most routinely used reading test in clinical practice. The TOPF will be explored in the context of Alzheimer's dementia (AD), Vascular dementia (VD) and mixed Alzheimer's and Vascular dementia (AVD). As it is well documented (e.g. Taylor, 1999; Cockburn et al., 2000) that reading ability becomes compromised with increasing severity of dementia, the study will focus on those with mild/moderate dementias.

In order to assess the robustness of the TOPF, the reading test-estimated IQ scores for people with a dementia will be compared against a matched healthy control group, and the three IQ estimators will be compared against one another between and within the two groups of participants.

The primary hypothesis for this study is:

- 1) Participants with a dementia will have significantly lower estimated IQs on a reading test of pre-morbid ability (TOPF) than matched healthy controls.

Secondary hypotheses are:

- 2) Participants with a dementia will have significantly lower estimated IQs on the TOPF than STW-2;
- 3) There will be no more than a medium effect size difference between the IQ estimates for participants with a dementia compared with the healthy control group on the STW-2; and
- 4) The discrepancy between a demographic based estimate of pre-morbid IQ and estimates derived from tests of reading ability will be significantly greater for those with dementia than healthy controls.

## **Method**

### ***Study design***

This was a cross-sectional study with two groups of participants assessed on three measures of premorbid ability. One group was a healthy control group, the other group was comprised of individuals with a diagnosis of dementia.

### ***Ethics approval***

This study was reviewed and given favourable opinion by the West of Scotland Ethics Committee in December 2014. The study proposal can be found in Appendix 2.2 and a copy of the Ethics approval letter in Appendix 2.3.

### ***Participants***

Patients with a diagnosis of probable Alzheimer's (AD), vascular (VD) or mixed Alzheimer's/vascular dementia (AVD) were recruited from two NHS Greater Glasgow and Clyde Older Adult Community Mental Health Teams (CMHTs) between February 2015 and July 2015. The diagnosis of a dementia was made by a psychiatrist using the ICD-10 criteria. Controls were recruited from the partners of patients to provide a match for age and socio-economic status.

Fifty-six patients within the CMHTs were identified by NHS staff as meeting the inclusion criteria and who had a partner. Of those identified, thirty were recruited to the study, twelve declined to participate, two **could not** be contacted, six were inappropriate referrals (e.g. ACE-III score was too high) and, when contacted by the researcher, five were too physically unwell and one had died.

All participants were administered the Addenbrooke's Cognitive Examination-III

(ACE-III) to screen for cognitive impairment. All participants in the dementia group were required as part of the inclusion criteria to have an ACE-III score of  $\leq 75$  and all controls were  $\geq 88$  (see 'Measures' for explanation). Other inclusion criteria included individuals up to the age of 84, as this is the maximum age for the STW-2 normative data (the TOPF being 89). Exclusion criteria included individuals with visual or auditory difficulties (which couldn't be corrected with the use of glasses or hearing aids); a history of stroke, a diagnosed or suspected learning difficulty such as dyslexia; expressive aphasia; current or previous serious psychiatric disorder; those whose first language was not English; and those individuals with other types of dementia.

### **Justification of sample size**

The sample size was based on a power calculation for an independent t-test, as this was the planned main method for statistical analysis. McFarlane et al.'s (2006) study found a medium effect size on reading tests between their 'minimal' and 'mild' dementia groups. For the current study, a medium effect size would provide clinically meaningful information about the utility of reading tests in estimating premorbid intelligence. Therefore, a G\*Power 3.010 (Faul, Erdfelder, Lang, & Buchner, 2007) calculation was computed to determine the number of participants required to achieve a medium effect size, using the values:  $p = 0.05$  and power = 0.8. This calculation suggested a minimum of 36 participants per group was required.

### **Measures**

The ACE-III copyright is held by Professor John Hughes and has been validated as a cognitive screening tool for Alzheimer's disease (Hsieh, Schubert, Hoon,

Mioshi, & Hodges, 2013). Cut-off scores of 88 and 82 (out of a possible 100) indicate a potential cognitive decline. A score of  $\leq 75$  was selected as the cut-off for people with a dementia due to a systematic review by Crawford, Whitnall, Robertson and Evans (2012), where ACE scores of  $\leq 75$  were likely to identify people as highly probable to have a dementia, with high sensitivity and specificity amongst people being assessed in memory clinics for possible dementia. The ACE-III was administered according to the test instructions (<http://www.neura.edu.au/frontier/research/tests-download/>) to determine the cognitive status of all participants.

The TOPF and STW-2 were administered according to the published test manual and instructions. Both the TOPF (Wechsler, 2011) and STW-2 (Baddeley & Crawford, 2012) have been validated and normed against the WAIS-IV. Participants were asked to read aloud the 70 TOPF words (unless they scored 0 on five consecutive items; in which case the test was discontinued) and to either read aloud or point to the correct word from 100 word-pairs on the STW-2. The order of administration of the TOPF and STW-2 was counterbalanced as they contain a small number of words which are the same or similar and were never administered immediately after one another. The ACE-III was completed in-between. This was to reduce the potential risk of practice effects on a few items.

The demographic equation used was Crawford and Allan's (1997), which provides an estimated WAIS-R (Wechsler, 1981). FSIQ estimate and which was compared against scores on the TOPF and STW-2. The demographic equation was:

$$\text{Predicted FSIQ} = 87.14 - (5.21 \times \text{occupation}) + (1.78 \times \text{years of education}) + (0.18 \times \text{age})$$

In line with the regression equation, “occupation” was classified into 5 categories: 1 = professional; 2 = intermediate; 3 = skilled; 4 = semi-skilled; and 5 = unskilled. Individuals who were retired, unemployed or who were housewives/husbands were categorised according to their previous occupation. Those who had never worked were classified as unskilled (code 5). Participants were credited with 0.5 years of education for every year of part-time education they had undertaken which was leading to a qualification, as detailed by Crawford and Allan (1997). Occupation was classified according to the Office of Population Censuses and Surveys (1980).

Updated regression equations have not been published to convert demographic-estimated IQs to the newer normative samples of the WAIS-IV, however Crawford and Allan’s (1997) equation was utilised in McFarlane et al.’s (2006) study.



## **Results**

### ***Preliminary analyses***

Demographic details for participants were analysed for the two groups and are presented in Table 6 below. The diagnoses (and percentage of the entire dementia group) of the dementia group were: AD=15 (50%), VD=8 (27%) and AVD=7 (23%). Results were not analysed separately by diagnosis as this would have reduced power and research suggests that tests of verbal ability (such as reading) and general intellectual functioning (IQ) are not able to discriminate Alzheimer's disease from vascular dementia (Mathias & Burke, 2009).

**Table 6: Demographic details of participants by group**

	<b>Controls</b> ( <i>n</i> = 30)	<b>Dementia</b> ( <i>n</i> = 30)	<b>Stats</b>	<b><i>p</i> value</b>
<b>Gender</b>				
Male	17	13	$X^2 = .067$	$p = .796$
Female	13	17		
<b>Age (in years)</b>				
Mean (SD)	75.33 (7.1)	75.80 (6.5)	$t = -.267$	$p = .791$
<b>Education (in years)</b>				
Mean (SD)	11.79 (3.1)	11.06 (2.7)	$t = .990$	$p = .326$
<b>ACE-III (max score = 100)</b>				
Mean (SD)	92.37 (3.3)	60.2 (13.5)	$t = 12.69$	$p < .0001$
<b>Occupational class</b> (Number in each group)				
1	2	2	$X^2 = 1.344$ (Fisher's Exact Test)	$p = .826$
2	10	7		
3	14	18		
4	4	3		
5	0	0		

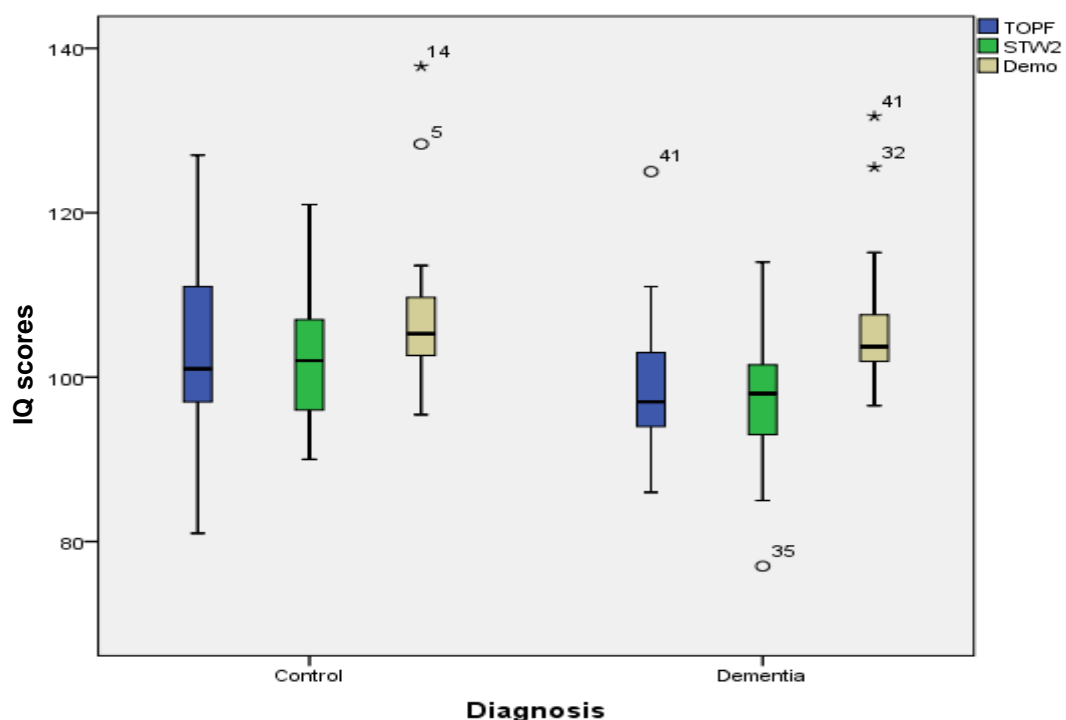
There were no significant differences between the groups on any of the demographic variables, with the exception of mean ACE-III scores ( $t(58) = 12.690$ ,  $p < .0001$ ), which was expected.

### *Data integrity*

All data were visually screened for outliers. There were missing data for the STW-2 test for three participants in the dementia group and one participant in the control group - testing on the STW-2 was abandoned for two participants in the dementia group who were becoming distressed by the task; the other participant in this group and the one healthy individual refused to complete the measure.

### *Distribution*

Assumptions of normality were investigated using histograms, box plots and Shapiro-Wilks tests. Box plots, as seen in Figure 2, revealed outliers on all measures; however inspection of the means, 5% trimmed means and medians revealed that these outliers did not impact significantly on the results. Shapiro-Wilks tests established that the assumption of normality was violated for both groups on the demographic equation, and for the dementia group on the TOPF.



**Figure 2: Box plots for IQ scores, by estimator and group**

Transformation of the data did not alter the distribution of scores and, therefore, the issue of non-normality was resolved with the use of non-parametric tests to analyse results for the TOPF and demographic equation. As the results for STW-2 in both groups were normally distributed, parametric tests were utilised for this test.

### ***Data analysis***

A combination of parametric and non-parametric tests was used to compare the two groups on the three measures of IQ. The independent variable was diagnosis i.e. healthy control or a diagnosis of dementia. The dependent variable was the premorbid IQ score. All hypotheses were tested at  $p < .05$ .

### ***Main hypotheses***

The means (M), standard deviations (SD), medians (Md) and inter quartile ranges (IQR) for each group on TOPF, STW-2 and the demographic equation are presented in Table 7.

**Table 7: Descriptive statistics for IQ measures by group**

	TOPF IQ	STW-2 IQ	Demo IQ
<b>Control (<math>n = 30</math>)</b>			
M	104.13	102.76	107.59
SD	11.3	8.8	8.6
Md	101.0	102.0	105.83
IQR	97.0 – 111.0	95.8 – 107.8	101.9 – 111.4
<b>Dementia (<math>n = 30</math>)</b>			
M	97.90	96.81	106.03
SD	8.5	7.8	7.7
Md	96.0	98.0	103.71
IQR	93.0 – 102.0	90.8 – 99.8	101.9 – 107.5

***Hypothesis 1: Participants with a dementia will have significantly lower estimated IQs on a reading test of pre-morbid ability (TOPF) than healthy controls.***

A Mann-Whitney  $U$  test revealed a significant difference on the TOPF between people with a dementia ( $Md = 96.0$ ,  $n = 30$ ) and matched healthy controls ( $Md = 101.0$ ,  $n = 30$ ;  $U = 266.5$ ,  $z = -2.816$ ,  $p = .007$ ,  $r = .36$ ). Therefore, the first hypothesis was confirmed, with a medium effect size.

***Hypothesis 2: Participants with a dementia will have significantly lower estimated IQs on the TOPF than STW-2.***

A Wilcoxon Signed Rank test revealed a non-significant difference between the TOPF ( $Md = 96$ ,  $n = 30$ ) and STW-2 ( $Md = 98.0$ ,  $n = 27$ ;  $z = -1.411$ ,  $p = .15$ ,  $r = .29$ ) for people with a dementia. Thus, the second hypothesis was not confirmed.

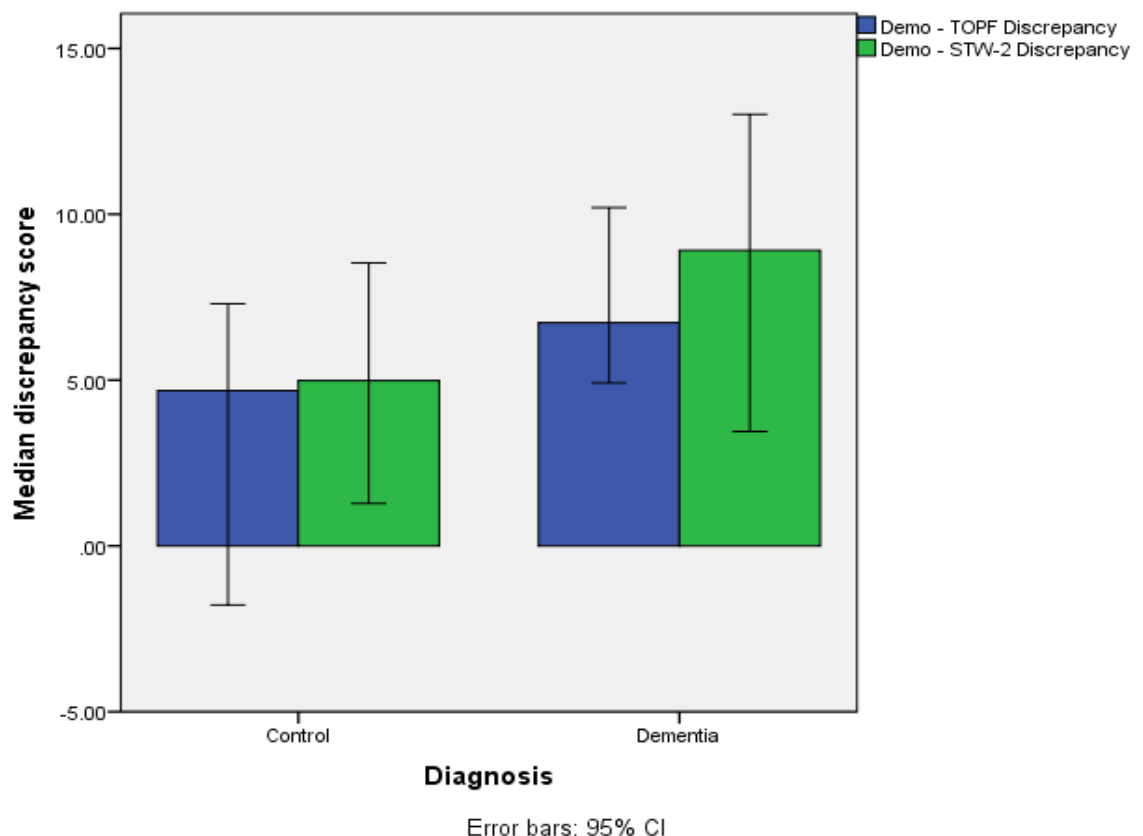
***Hypothesis 3: There will be no more than a medium effect size difference between the IQ estimates for participants with a dementia compared with the healthy control group on the STW-2.***

An independent  $t$ -test found a significant difference on the STW-2 between people with a dementia ( $M = 96.8$ ,  $SD = 7.8$ ) and healthy individuals ( $M = 102.8$ ,  $SD = 8.8$ ;  $t(48) = 2.837$ ,  $p = .010$ ). There was a mean difference between the groups of 6.94 (95% CI: 1.45 – 10.44) with an effect size just above medium ( $r = .34$ ). Therefore, the third hypothesis was supported.

***Hypothesis 4: The discrepancy between a demographic based estimate of pre-morbid IQ and estimates derived from tests of reading ability will be significantly greater for those with dementias than healthy controls.***

Discrepancy scores were calculated (for each individual) between the demographic equation and the two reading tests. The median scores for each group and IQ estimator and are seen below in Figure 3.

There was no significant difference between the control group ( $Md = 105.83$ ,  $n = 30$ ) and the dementia group ( $Md = 103.71$ ,  $n = 30$ ;  $U = 387.0$ ,  $z = -.932$ ,  $p = .354$ ,  $r = .12$ ) on the demographically-estimated IQ.



**Figure 3: Median discrepancy scores between demographic equation IQ and reading test IQ by group**

For TOPF vs demographic equation discrepancy scores there was a significant difference between controls ( $Md = 4.93$ ,  $n = 30$ ) and participants with a dementia ( $Md = 6.82$ ,  $n = 30$ ;  $U = 316.0$ ,  $z = -1.981$ ,  $p = .048$ ,  $r = -.26$ ). There

was also a significant difference in STW-2 vs demographic equation discrepancy scores between controls ( $Md = 4.98$ ,  $n = 29$ ) and people with a dementia ( $Md = 8.91$ ,  $n = 27$ ;  $U = 266.5$ ,  $z = -2.05$ ,  $p = .04$ ,  $r = .27$ ). The fourth hypothesis was confirmed, with a small-to-medium effect size.

An additional analysis was undertaken to compare the reading test vs demographic equation discrepancies within groups, using Wilcoxon Signed Ranked tests.

In healthy individuals, there was no significant difference between the TOPF vs demographic discrepancy score ( $Md = 4.93$ ,  $n = 30$ ) and the STW-2 vs. demographic discrepancy score ( $Md = 4.98$ ,  $n = 29$ ;  $z = -1.106$ ,  $p = .269$ ,  $r = .14$ ).

There was also no significant difference between the TOPF vs demographic discrepancy score ( $Md = 6.82$ ,  $n = 30$ ) and the STW-2 vs. demographic discrepancy score ( $Md = 8.91$ ,  $n = 27$ ;  $z = -1.411$ ,  $p = .158$ ,  $r = .19$ ) in people with a dementia. Therefore, within groups there was no difference between the discrepancy scores.

### ***Further analyses***

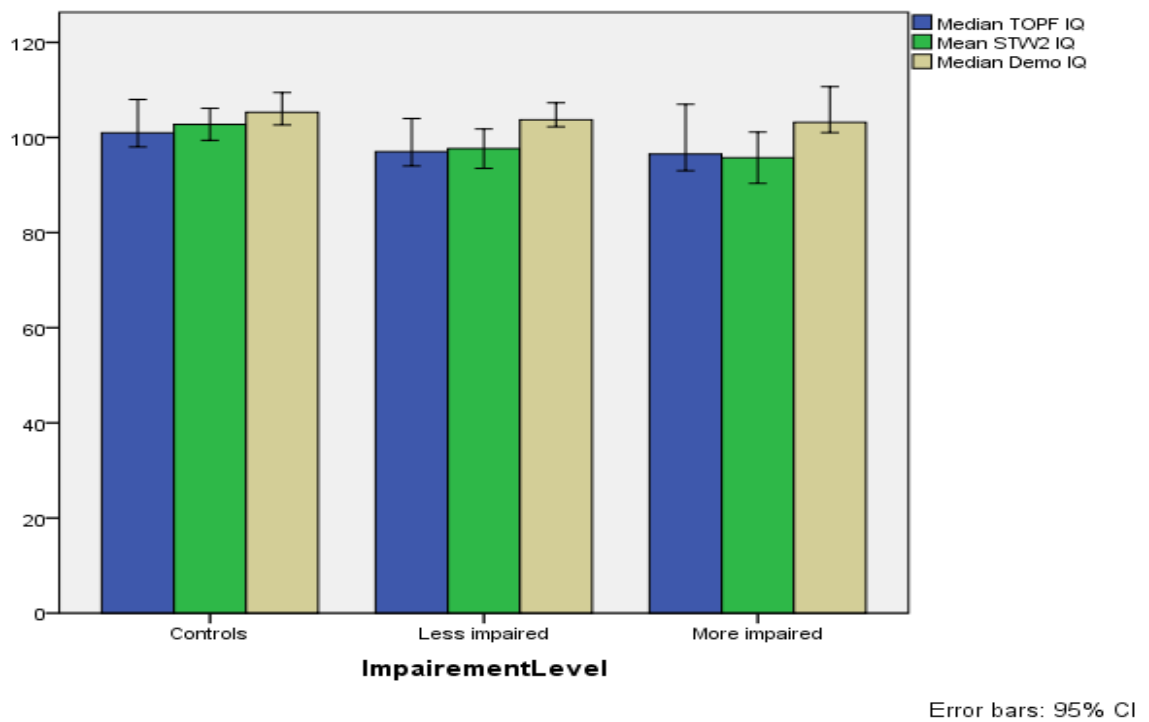
As severity of disease has been reported to affect the validity of reading tests, a further analysis was undertaken to explore this. The manuals for both reading tests recommend the use of a combined “reading-test plus demographic variables” which is achieved using an accompanying CD ‘Scorer’ – therefore an

analysis was undertaken to ascertain whether there was any difference between the reading tests and the combined approach. The combined approach will henceforth be called “Scorer” (ie ‘TOPFScorer and STW-2Scorer’). Correlations were undertaken to determine how well the three IQ estimators correlated with one another. Finally, the difference discovered between healthy controls and people with a dementia was examined to determine what, if any, implications there may for clinical practice.

### *Severity of dementia*

As this study did not use a measure such as the Mini Mental State Examination (MMSE; Folstein, Folstein and McHugh, 1975), which has traditionally been utilised to categorise severity levels of dementia (e.g. Patterson, Graham & Hodges, 1994), the dementia group was arbitrarily split into two based on the median score on the ACE-III, which was 65. Thus a “less impaired” group ( $n = 15$ ) constituted an ACE-III score of  $\geq 65$  and a “more impaired” group ( $n = 15$ ) was comprised of individuals with a score of  $< 65$ .

Tests were re-run on the TOPF, STW-2 and demographic equation for the control and “less impaired” dementia group and the control and “more impaired” dementia group. The results are displayed in Figure 4.



**Figure 4: Mean and median IQ scores for healthy controls, “less impaired” and “more impaired” dementia groups, by estimator**

The results were no longer significantly different between healthy individuals ( $Md = 101.0$ ,  $n = 30$ ) and the “less impaired” group ( $Md = 97.0$ ,  $n = 15$ ) for the TOPF ( $U = 159.5$ ,  $z = -1.579$ ,  $p = .114$ ,  $r = 0.24$ ). There was also no significant difference between healthy controls ( $Md = 105.8$ ,  $n = 30$ ) and the “less impaired” group ( $Md = 103.7$ ,  $n = 15$ ) on the demographic equation ( $U = 196.5$ ,  $z = -.686$ ,  $p = .493$ ,  $r = .10$ ). Finally there was a non-significant result between the control ( $M = 102.8$ ,  $SD = 8.8$ ) and the “less impaired” dementia group ( $M = 97.7$ ,  $SD = 7.5$ ) for the STW-2 ( $t(42) = 1.904$ ,  $p = .064$ ,  $r = .29$ , 95% CI  $-.31 - 10.5$ ).

There was a significant difference on the TOPF for the control group ( $Md = 101.0$ ,  $n = 30$ ) and the “more impaired” group ( $Md = 96.0$ ,  $n = 15$ ;  $U = 112.0$ ,  $z = -2.726$ ,  $p = .006$ ,  $r = 0.41$ ). The difference on the STW-2 between the controls ( $M = 102.8$ ,  $SD = 8.8$ ) and the “more impaired” group ( $M = 95.7$ ,  $SD = 8.5$ ;  $t(39)$



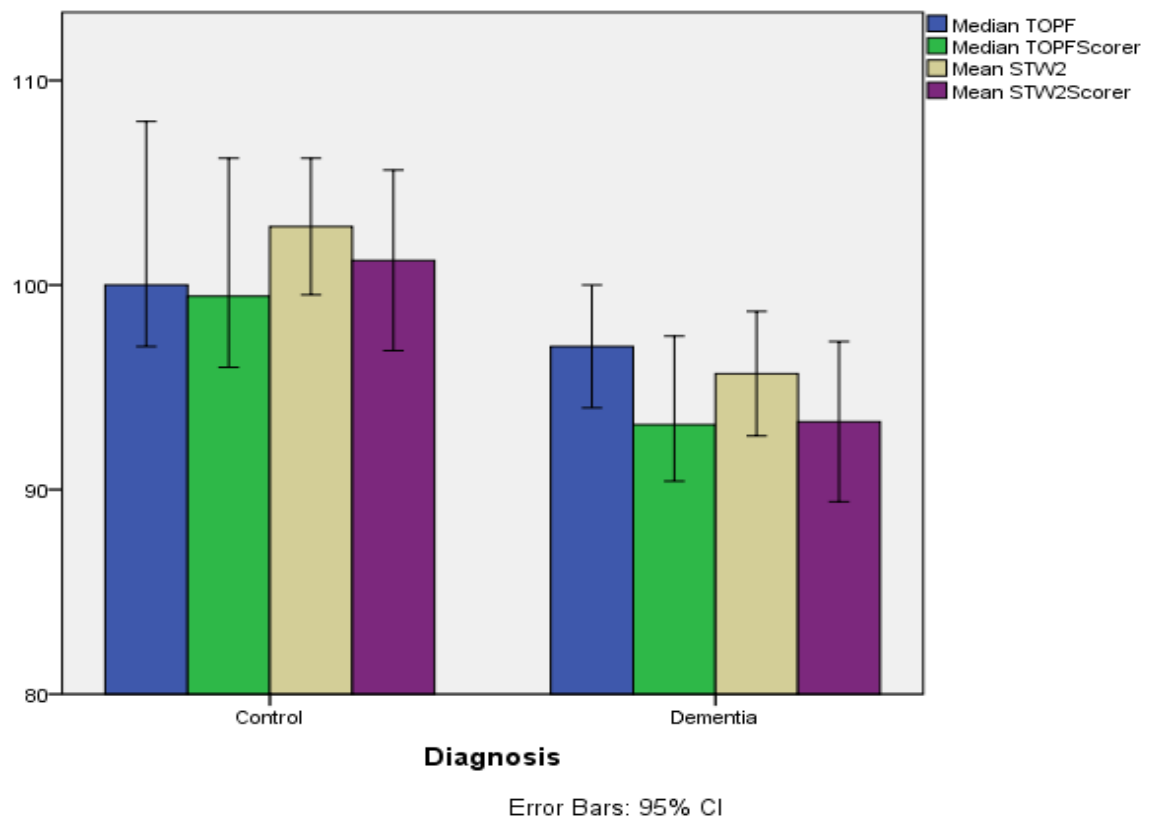
= 2.335,  $p = .025$ ,  $r = .38$ , 95% CI: 0.9 – 13.1) was also statistically significant. There was no such difference on the demographic equation between the controls ( $Md = 105.8$ ,  $n = 30$ ) and the “more impaired” group ( $Md = 103.7$ ,  $n = 15$ ;  $U = 190.5$ ,  $z = -.831$ ,  $p = 0.406$ ,  $r = 0.12$ ).

Despite these differences in statistical significances between the groups, it must be noted that the dementia group was split into two, thus each containing only fifteen participants per group. The implications of this and consideration of the different effect sizes are considered further in the discussion section.

#### *Combined reading test scores and demographic variables*

The accompanying manuals for TOPF and STW-2 recommend using the reading test score plus age and years of education to determine premorbid IQ. A CD-Rom ‘Scorer’ is provided with the test materials to allow clinicians to enter the appropriate data and the ‘Scorer’ then computes the IQ score. These ‘Scorer’ estimated IQs were calculated for each patient and compared against reading test-only estimated IQs. The results are presented below in Figure 5.

There were significant differences between the TOPF ( $Md = 96.0$ ,  $n = 30$ ) and TOPFScorer ( $Md = 94.5$ ,  $n = 30$ ;  $z = -2.458$ ,  $p = .014$ ,  $r = .32$ ) and the STW-2 ( $M = 96.8$ ,  $SD = 7.8$ ) and STW-2-Scorer ( $M = 94.8$ ,  $SD = 9.9$ ;  $t(26) = 2.519$ ,  $p = .018$ ) for people with a dementia. The Scorer provided a slightly lower estimated IQ score than the reading tests alone in people with a dementia.

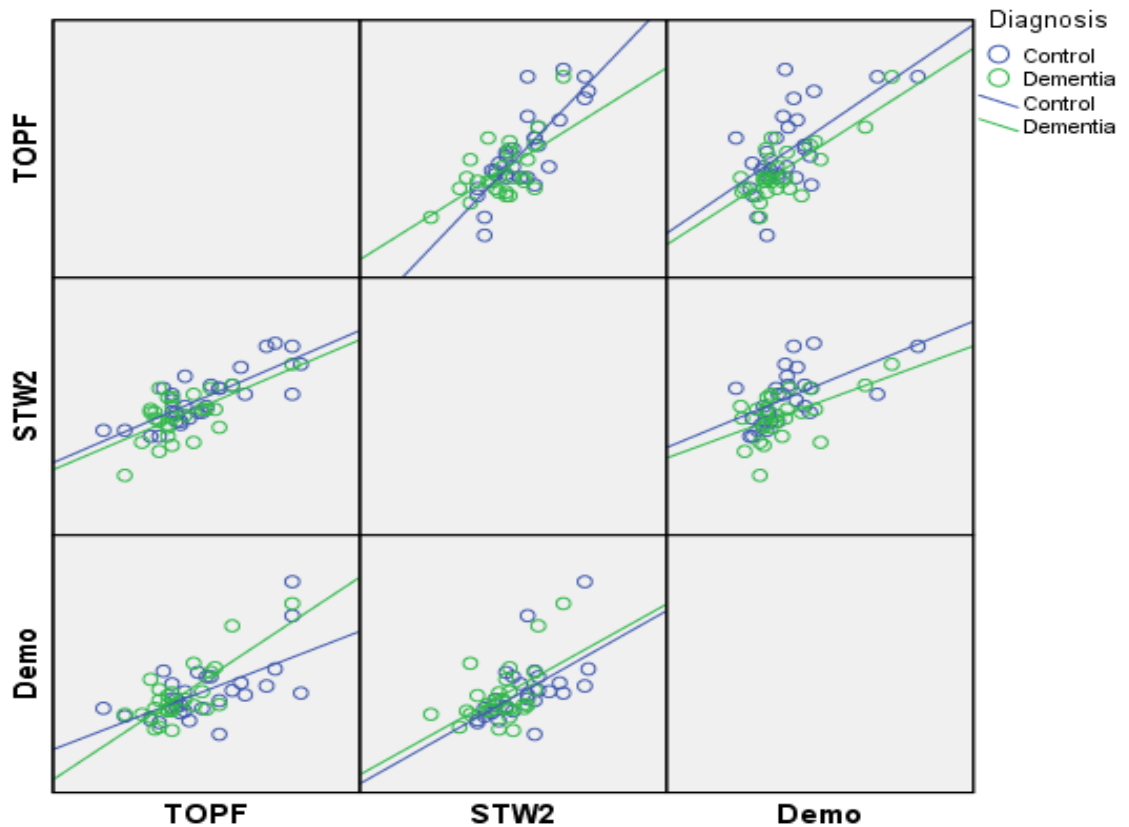


**Figure 5: Comparison of reading test-estimated IQ scores and Scorer-estimated IQ scores, by group**

A Wilcoxon Signed Rank test revealed a significant difference between the TOPF ( $Md = 101.0$ ,  $n = 30$ ) and the TOPFScorer ( $Md = 99.7$ ,  $n = 30$ ) and a paired t-test significant found difference between the STW-2 ( $M = 102.8$ ,  $SD = 8.8$ ) and STW-2Scorer ( $M = 100.7$ ,  $SD = 11.8$ ;  $t(28) = 2.439$ ,  $p = .018$ ) for controls. The Scorer provided a slightly lower estimated IQ score than the reading tests alone in healthy individuals.

#### *Association between measures*

For both groups, Spearman's rho correlations were undertaken between the TOPF, STW-2, demographic equation and the scatter plots are presented in Figure 6.



**Figure 6: Scatter plots of the relationships between IQ estimators for each group**

In the control group, there were significant positive relationships between the TOPF and STW-2 ( $\rho = .766, p < .001$ ), the TOPF and the demographic equation ( $\rho = .507, p = .004$ ) and the STW-2 and the demographic equation ( $\rho = .674, p < .001$ ).

For the dementia group, there was a significant positive relationship between the TOPF and STW-2 ( $\rho = .453, p = .018$ ), the TOPF and the demographic equation ( $\rho = .479, p = .007$ ) and the STW-2 and the demographic equation ( $\rho = .441, p = .021$ ). The three measures all appeared to correlate significantly with one another overall and within groups.

## **Discussion**

This study sought to investigate three measures of estimating premorbid intelligence: a reading test (TOPF), a lexical-decision making test (STW-2) and a demographic equation. The main aim was to determine how the TOPF compared to these other estimators in people with an Alzheimer's, vascular or mixed dementia. As the control and dementia groups were well-matched on age and years of education, these variables were unlikely to have impacted on the results.

### ***Findings of this study***

#### *Comparison of reading-based tests*

The TOPF and STW-2 provided similar scores for people with a dementia and there was no significant difference between the two. Therefore, neither one is superior to the other in estimating IQ. It is interesting to note that three participants with dementia and one healthy individual were either distressed by the STW-2 or refused to complete it. Nearly all participants stated a preference for the TOPF, perhaps due to the fact that the test starts with relatively simple words to read aloud and then gradually increases in difficulty. In contrast, the STW-2 was often perceived as challenging from the first or second page of word-pairs. Furthermore, the TOPF can be completed in a much shorter time than the STW-2, and there is a discontinuation rule for 5 consecutive scores of '0'; therefore the test was discontinued reasonably soon after the demands of the task exceeded the individual's capabilities. The STW-2, however, has no discontinuation rule and thus participants were required to complete all 100 word-pairs regardless of performance.

### *Reading-based test IQs vs. demographically-based IQs*

The control group and dementia group were comparable with one another in terms of their demographic equation-estimated IQ scores but different from one another on their reading test-estimated IQ scores. There was a greater discrepancy for people with a dementia between the demographic equation IQ and the reading tests than for healthy matched controls. The demographic equation (used for both the control and dementia group) has to be treated with some caution given that it was based on the WAIS-R (see 'limitations' section).

### *Combined reading test scores and demographic variables (Scorer)*

The reading tests on their own appeared to provide a slightly higher IQ score for both healthy individuals and people with a dementia. This study found that the TOPF and STW-2 estimated IQs for people with a dementia were at least 5 IQ points lower compared with matched controls, and the Scorer provided a lower score still. This raises the possibility that the reading tests are underestimating premorbid IQ in people with dementia, and in the sample for this study the Scorer exaggerated this underestimate.

### *Severity of dementia and performance on reading-based tests*

Participants with a dementia could not be formally classified into severity levels as this would have required the use of a tool validated for this purpose. Participants were likely to have a mild / moderate level of dementia as all could follow instructions and had been deemed able to provide consent to participate by the NHS team.

There was a wide variation in scores on the ACE-III demonstrating that some participants were more cognitively impaired than others. The arbitrary classification into “less impaired” and “more impaired” did provide a method of categorising severity, albeit one which has not been validated. After this classification, there was no longer a significant difference between the “less impaired” dementia groups and the control group on the TOPF and STW-2 but there remained a significant difference for the “more impaired” group.

The two dementia groups, however, were small in number (both  $n = 15$ ) and it may be more meaningful to consider the effect sizes. Overall, a medium effect size was evident between the control group and entire dementia group on the TOPF and STW-2. These effect sizes were only reduced slightly in the less impaired group, and still suggested a medium size difference. Effect sizes were slightly higher for the “more impaired” group. Differences in statistical significance are likely to be due to a modest sample size and accompanying lack of power.

#### *Clinical implications of inaccurate TOPF scores for people with a dementia*

The actual difference in IQ scores on the TOPF was approximately 5 IQ points lower for people with a dementia. It is important for practitioners to understand the extent to which this might impact on the clinical interpretation of obtained-minus-predicted IQ scores. The TOPF ‘Scorer’ provides a method of investigating this by comparing the obtained (i.e. WAIS-IV) IQ and the predicted (i.e. TOPF) premorbid IQ. If the “true” obtained-minus-predicted discrepancy score for an individual was 10 IQ points, the TOPF ‘Scorer’ suggests that this degree of discrepancy would only be exhibited by approximately 15% of the UK

population which is relatively uncommon. However, if the TOPF-predicted IQ is 5 points lower than it should be, this would provide an obtained-minus-predicted discrepancy score of 5 IQ points, which the TOPF 'Scorer' suggests would be exhibited by approximately 30% of the UK population and which would be relatively common. The confidence intervals for these percentages are quite large, suggesting the results should be analysed and reported cautiously, however it is often the primary statistic (i.e. 15% or 30%) which is considered in practice.

This highlights that such an inaccuracy on the TOPF may have an effect on how discrepancy results are interpreted and, in the cases of mild dementia, may disconfirm a diagnosis of dementia for the patient when in fact there has been a decline in functioning.

### ***Limitations of the study***

The G\*Power calculation recommended a minimum of 36 participants per group and only 30 were able to be recruited, although this was still enough to detect a medium effect size between the groups on the reading tests. Had there been a larger number of participants, there may have been enough power to detect a significant finding when the dementia group was split into two.

The present study also relied on a comparison between the healthy controls and the dementia patients, with the assumption that they would have similar IQs. Some research tentatively suggests that people who develop a dementia have lower levels of intellectual functioning and this may have been the case for

the dementia group in the current study. Whalley, Starr, Athawes, Hunter, Pattie and Deary (2000) examined data from the 1932 Scottish birth cohort (where children were given IQ tests aged 11) and discovered that mental ability scores were significantly lower in children who eventually developed late-onset dementia compared with those who did not. The groups in the current study, however, were well matched in terms of age, gender, years of education and occupational status, all factors known to affect intelligence, and thus the risk of bias in terms of the dementia group having lower IQs was minimised.

This study had to rely on a demographic equation which was developed to estimate WAIS-R IQs; this was necessary because there have not been any updated regression equations for the WAIS-IV. Both the TOPF and STW-2 have been normed against the WAIS-IV; therefore the comparability of the reading-based tests IQ scores and demographic equation IQ scores is problematic and these results should be interpreted cautiously.

Previous versions of the WAIS have been investigated as to the comparability of scores. For example, Crawford et al. (1990) explored the comparability of the WAIS and WAIS-R in a UK sample and reported mean differences for FSIQ, VIQ and PIQ of 7.5, 6.4, and 7.9, respectively, with participants scoring lower on the WAIS-R across each domain. The increased difficulty of new IQ tests is to account for the Flynn effect (Flynn, 2007) – the finding that individuals will show an increase of approximately 3 IQ points per decade.



The WAIS-R demographic calculation may have provided an over-inflated IQ score and thus the difference between this and the reading-based test IQ may have been smaller than reported in this study. However, as the same equation was used for both groups, the key issue is the degree of discrepancy for each group between the demographic equation and the reading tests; there were no differences within groups between these discrepancy scores, however there were significant differences between healthy controls and people with a dementia on discrepancy scores for both reading tests.

### ***Findings of this study in comparison to other studies***

The results of the current study confirm those of McFarlane et al.'s (2006) findings; there was a deterioration in word-reading ability in people with a dementia. The current study did find differences between groups on STW-2, which is in contrast to McFarlane et al.'s study. This could be accounted for by the fact that the current study used a newer (and different) version of the STW-2 and may have included more impaired participants.

Other researchers have also reported a deterioration in word-reading ability for people with a dementia. Lowe and Rogers (2011) investigated the American version of the NART and found scores declined as cognitive impairment increased. Taylor et al. (1996) also demonstrated that estimates of verbal IQ declined over time in a longitudinal study. Paque and Warrington (1995) concluded that the NART was a useful estimator of premorbid intelligence in early dementia although observed a modest decline in NART-estimated IQs ( $M = 5$  IQ points lower). This finding of a reduction in IQ by approximately 5 IQ points is consistent with the results of the current study. Fromm, Holland, Nebes

and Oakley (1991) conducted a longitudinal study of the NART in controls and people with Alzheimer's disease over a three-year period and found not only that controls scored better than the dementia group at each testing but that people with a dementia scored significantly worse over time. The current study also noted a difference between healthy controls and people with a dementia.

The above studies are, however, qualitatively different from the current study, in that they are longitudinal and the current study assessed people at one time point. The longitudinal studies recruited patients with a mild dementia and tracked them over time, which suggests severity of dementia was increasing. The present study recruited patients with a likely mild/moderate dementia who may or may not be comparable with the participants in the above studies after they had been retested. The fact that the current study did not formally assess the severity levels of participants with a dementia makes it hard to compare against these other studies.

### ***Future research***

One obvious possibility for future research is to replicate this study with a larger number of participants, particularly within the "dementia" group so that when the group is split into severity levels the study has a greater degree of power to detect differences between measures and groups.

Utilising a recognised tool for assessing severity of dementia, such as the MMSE, would also provide a validated method of identifying the score at which the TOPF becomes compromised in people with a dementia. This would

provide clinicians with a more concrete answer as to when the TOPF can be used with relative confidence (e.g. a score of  $\geq 20$  on the MMSE).

Furthermore, a larger scale study with a longer period of recruitment could also administer a measure of current (obtained) IQ score (e.g. a current WAIS). This would then allow predicted and obtained scores to be calculated between matched healthy controls and people with a dementia.

There are currently no updated demographic regression equations for the WAIS-IV and if such an equation were developed, it could be compared with the TOPF, STW-2 and an obtained WAIS-IV IQ. This would then give an indication as to which method may be the most accurate in estimating premorbid intelligence.

Much of the current research on the validity of reading tests in estimating premorbid intelligence involves older tests such as the NART which are no longer used in clinical practice. Furthermore, many of these studies were poorly reported (e.g. did not provide details of years of education or occupational status) and failed to match controls with patients. Therefore, more stringent research is required in this field addressing some of these issues.

## **Conclusion**

This study has found differences between people with a dementia and matched healthy controls on the TOPF and STW-2, albeit a relatively small difference. Other studies have reported some similar results, although they are not directly

comparable with the current study and often suffered from poor reporting standards.

In conducting a neuropsychological assessment of an individual to determine whether there is evidence of a dementia, a range of tests may be used to assess a variety of cognitive domains. Typically these domains might include episodic memory, language and semantic knowledge, abstract reasoning, visuospatial abilities, attention and executive functioning (Salmon & Bondi, 2009). It is common practice, where practical, to also try to establish whether there has been a more general decline in intellectual functioning, by assessing current IQ and comparing this against an estimate of premorbid IQ (such as a reading test-estimated IQ). If reading tests systematically underestimate premorbid IQ in people who do have a dementia then clinicians may inadvertently conclude that the person is showing relatively little decline in IQ and there is no evidence suggestive of a dementia. The confidence intervals around the relative frequency of obtained-minus-predicted IQ discrepancies should alert clinicians to exercise caution when interpreting reading test scores.

The results of this study further highlight that such caution is necessary when considering the results of reading tests such as the TOPF and STW-2 and with clear reference to the clinical history and other cognitive test results.

Although this is a small-scale study and conclusions must be drawn tentatively, the results suggest the TOPF is not a particularly robust measure of premorbid intelligence in people with a dementia.

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## **Chapter 3: Advanced Clinical Practice I- Reflective Critical Account**

### **A changing relationship with Cognitive Behavioural Therapy**

#### **Abstract**

In this reflective account I apply Gibb's (1988) reflective model combined with elements of John's (1994) model of structured reflection to my first two years of Doctorate training. Using these models, I identify my initial preconceptions about the applicability and utility of Cognitive Behavioural Therapy and consider my changing perspective across this time period as I gained experience in using the model with different patient groups.

From this process I consider how I have assimilated these polarised positions and learning experiences into a more balanced perspective and how the process of reflection will guide me as I prepare to once again work within the limits of an adult Community Mental Health team.

Finally I consider how financial and service constraints impact on the stepped care model and Clinical Psychology, and how I can find my place within this.

## **Chapter 4: Advanced Clinical Practice II- Reflective Critical Account**

### **From the “Ivory Tower” to the board room: Clinical Psychology as part of the Multi-Disciplinary Team**

#### **Abstract**

Team-working is a core component of the work of Clinical Psychologists. In this reflective account I apply Gibb's (1988) reflective model combined with John's (1994) model of structured reflection to consider my experiences of working in Multi-Disciplinary Teams (MDTs) across the three years of my training.

From this process I consider how professional status and boundaries, organisational cultures and pressures, and historical contexts have affected the development of the teams I have been a part of. I also explore my personal reactions and contributions to these systems and how my own insecurities have affected my ability to interact with both well-integrated and less well integrated teams.

Finally I consider what learning points I need to take forward in the future as I move towards becoming a qualified practitioner seeking to make my own contribution to the field of Psychology and Multi-Disciplinary working.

## Appendix 1.1: Publication ‘Instructions for Authors’

*Psychological Assessment*® is concerned mainly with empirical research relevant to assessments conducted in the broad field of clinical psychology. Integrative reviews of research in this area are also welcome.

Relevant topics include

- clinical judgment and the application of decision-making models
- paradigms derived from basic psychological research in cognition, personality–social psychology, and biological psychology
- development, validation, and application of assessment instruments, scales, observational methods, and interviews
- research on clinical judgment and decision-making
- studies supporting or leading to translation of basic psychological research in cognition, personality–social psychology, and biological psychology to clinical psychological assessment

The focus of the journal is on all aspects of clinical assessment.

Clinically-focused assessment of personality, psychopathological symptoms, cognitive and neuropsychological processes, and interpersonal behavior are all relevant. Methodological, theoretical, and review articles addressing clinical assessment processes and methods are also welcome.

Investigations supporting clinical assessment in mental health, medical, forensic, and personnel screening settings are welcome. Research on under-studied populations is particularly encouraged. Case studies will be considered if they make unique contributions to clinical psychological assessment. Papers that focus on measurement theory and methods will be considered if specifically focused on issues in clinical assessment.

### Submission

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Manuscripts concerned with the development of a new assessment instrument should include a copy of the instrument.

In general, manuscripts should be no longer than 40 pages (this includes all elements of the manuscript, with the exception of any supplemental material).

Submit manuscripts electronically through the [Manuscript Submission Portal](#).

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This journal has adopted a masked review policy for all submissions. Authors should make every effort to ensure that the manuscript itself contains no clues to their identities. Authors' names and affiliations should not appear in the manuscript. Instead, please include this information in just the cover letter.

Please ensure that the final version for production includes a byline and full author note for typesetting.

## Brief Reports

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*Psychological Assessment* will review brief reports of research studies in clinical assessment. The procedure is intended to permit the publication of carefully designed studies with a narrow focus or of specialized interest.

An author who submits a brief report must agree not to submit the full report to another journal of general circulation. The brief report should give a clear, condensed summary of the procedure of the study and as full an account of the results as space permits.

The brief report should be limited to 19 manuscript pages (1" margins, size 12 font). This includes the title page, abstract, author note, text, reference list, and any footnotes, tables, and figures. The number of tables and figures should be limited.

The author is encouraged to limit the number of headings within the brief report and to combine headings whenever possible. For example, the Results and Discussion sections can be combined. Also, subheadings under the Method section can often be omitted.

Authors are encouraged but not required to have available an extended report. If one is available, the author note of the brief report should include the following statement:

Correspondence concerning this article (and requests for an extended report of this study) should be addressed to [give the author's full name and address].

## Research on Translations of Tests

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*Psychological Assessment* rarely publishes in print psychometric studies of translations of tests unless the papers also address some conceptual or methodological issue of broader interest to clinical assessment.

However, we have a special **online only publishing option** for such Research on Translations of Tests articles. With this option, manuscripts undergo our normal review process and are held to the same standards of review as all other submissions to the journal, but, if accepted, they would **not** appear in the print version of the journal but rather online only.

Studies appropriate for this option must have a focus consistent with the editorial scope of the journal, which emphasizes clinical assessment research.

These articles would be listed in all Tables of Contents (online and print), would be clearly identified as published "Online Only," and the DOI identifier would be included in the Table of Contents. Also, full text copies of the translated tests would go into PsycTESTS.

Translations of commercially published tests are not eligible for review in this category because, in addition to copyright constraints, such translations are not consistent with the goals of our Research on Translations of Tests program or PsycTESTS. Translations of single scales are also not eligible.

Authors wishing to submit manuscripts in this category should select the "Research on Translations of Tests" article type when submitting their manuscript.

## Manuscript Preparation

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Prepare manuscripts according to the [Publication Manual of the American Psychological Association \(6<sup>th</sup> edition\)](#). Manuscripts may be copyedited for bias-free language (see Chapter 3 of the *Publication Manual*).

Review APA's [Checklist for Manuscript Submission](#) before submitting your article.

Double-space all copy. Other formatting instructions, as well as instructions on preparing tables, figures, references, metrics, and abstracts, appear in the *Manual*.

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We strongly encourage you to use MathType (third-party software) or Equation Editor 3.0 (built into pre-2007 versions of Word) to construct your equations, rather than the equation support that is built into Word 2007 and Word 2010. Equations composed with the built-in Word 2007/Word 2010 equation support are converted to low-resolution graphics when they enter the production process and must be rekeyed by the typesetter, which may introduce errors.

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- Select MathType or Equation Editor 3.0 in the drop-down menu.

If you have an equation that has already been produced using Microsoft Word 2007 or 2010 and you have access to the full version of MathType 6.5 or later, you can convert this equation to MathType by clicking on MathType Insert Equation. Copy the equation from Microsoft Word and paste it into the MathType box. Verify that your equation is correct, click File, and then click Update. Your equation has now been inserted into your Word file as a MathType Equation.

Use Equation Editor 3.0 or MathType only for equations or for formulas that cannot be produced as Word text using the Times or Symbol font.

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Because altering computer code in any way (e.g., indents, line spacing, line breaks, page breaks) during the typesetting process could alter its meaning, we treat computer code differently from the rest of your article in our production process. To that end, we request separate files for computer code.

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If you would like to include code in the text of your published manuscript, please submit a separate file with your code exactly as you want it to appear, using Courier New font with a type size of 8 points. We will make an image of each segment of code in your article that exceeds 40 characters in length. (Shorter snippets of code that appear in text will be typeset in Courier New and run in with the rest of the text.) If an appendix contains a mix of code and explanatory text, please submit a file that contains the entire appendix, with the code keyed in 8-point Courier New.

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Use Word's Insert Table function when you create tables. Using spaces or tabs in your table will create problems when the table is typeset and may result in errors.

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List references in alphabetical order. Each listed reference should be cited in text, and each text citation should be listed in the References section.

Examples of basic reference formats:

- **Journal Article:**  
Hughes, G., Desantis, A., & Waszak, F. (2013). Mechanisms of intentional binding and sensory attenuation: The role of temporal prediction, temporal control, identity prediction, and motor prediction. *Psychological Bulletin*, 139, 133–151. <http://dx.doi.org/10.1037/a0028566>
- **Authored Book:**  
Rogers, T. T., & McClelland, J. L. (2004). *Semantic cognition: A parallel distributed processing approach*. Cambridge, MA: MIT Press.
- **Chapter in an Edited Book:**  
Gill, M. J., & Sypher, B. D. (2009). Workplace incivility and organizational trust. In P. Lutgen-Sandvik & B. D. Sypher (Eds.), *Destructive organizational communication: Processes, consequences, and constructive ways of organizing* (pp. 53–73). New York, NY: Taylor & Francis.

### Figures

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Graphics files are welcome if supplied as Tiff or EPS files. Multipanel figures (i.e., figures with parts labeled a, b, c, d, etc.) should be assembled into one file.

The minimum line weight for line art is 0.5 point for optimal printing.

For more information about acceptable resolutions, fonts, sizing, and other figure issues, [please see the general guidelines](#).

When possible, please place symbol legends below the figure instead of to the side.

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In addition, APA Ethical Principles specify that "after research results are published, psychologists do not withhold the data on which their conclusions are based from other competent professionals who seek to verify the substantive claims through reanalysis and who intend to use such data only for that purpose, provided that the confidentiality of the participants can be protected and unless legal rights concerning proprietary data preclude their release" (Standard 8.14).

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## Appendix 1.2: Detailed search strategy

1. AB dement\* OR AB alzheimer\* OR AB multi?infarct dement\* OR AB cognitive deterioration OR AB cognitive decline OR AB intell\* deterioration OR AB mental deterioration OR MM dementia OR MW Alzheimers OR MW dementia, vascular
2. AB pre?morbid IQ OR AB pre?morbidintell\* OR AB pre?morbidestimat\* OR AB pre?morbidabilit\* OR AB intell\* OR AB estimat\* pre?morbid OR AB estimat\* intell\* OR MW Psychometrics OR MW Intelligence OR MW Intelligence tests
3. AB read\* OR AB reading test\* OR AB reading abilit\* OR AB irregular word\* OR MW reading
4. AB VIQ OR AB verbal IQ OR AB verbal intell\* OR AB demographic equation\* OR AB demographic regression equation\* OR AB demographic variable\* OR MW psychometrics OR MW intelligence tests OR MW intelligence OR MW neuropsychological tests
5. Combine 1 AND 2 AND 3 AND 4
6. Limit 5 to "English" and "All adult"

### Appendix 1.3: Quality Rating Checklist

#### STROBE 2007 (v4) checklist of items to be included in reports of observational studies in epidemiology

#### Checklist for cohort, case-control, and cross-sectional studies (combined)

Section / Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	
<b>INTRODUCTION</b>			
Background / rationale	2	Explain the scientific background and rationale for the investigation being reported	
Objectives	3	State specific objectives, including any pre-specified hypotheses	
<b>METHODS</b>			
Study design	4	Present key elements of study design early in the paper	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	
Participants	6	<p>(a) <i>Cohort study</i> - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up. For matched studies, give matching criteria and number of exposed and unexposed</p> <p><i>Case-control study</i> – Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls. For matched studies, give matching criteria and the number of controls per case</p> <p><i>Cross-sectional study</i>—Give the eligibility criteria, and the sources and methods of selection of participants</p>	/1

Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders and effect modifiers	
Data sources / measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical	12	(a) Describe all statistical methods, including those used to control for confounding variables	
		(b) Describe any methods used to examine subgroups and interactions	
		(c) Explain how missing data were addressed	
		(d) <i>Cohort study</i> – If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> – Explain how matching of cases and controls was addressed <i>Cross-sectional study</i> – If applicable, describe analytical methods taking account of sampling strategy	/1
		(e) Describe any sensitivity analyses	
<b>RESULTS</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study – e.g. numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completed follow-up, and analysed	
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (e.g. demographic, clinical, social) and information on exposures and potential confounders. <i>Cohort study</i> - Summarise the follow-up time (e.g. average and total amount)	
		(b) Indicate number of participants with missing data for each variable of interest	/1
Outcome data	15*	<i>Cohort study</i> - Report numbers of outcome events or summary measures over time <i>Case-control study</i> – Report numbers in each exposure category, or summary of measures of exposure <i>Cross-sectional study</i> – Report numbers of outcome events or summary measures	/1

Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included AND (b) Report category boundaries when continuous variables were categorized	/1
Other analyses	17	Report other analyses done—e.g. analyses of subgroups and interactions, and sensitivity analyses	
<b>DISCUSSION</b>			
Key results	18	Summarise key results with reference to study objectives	
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	
Generalisability	21	Discuss the generalisability (external validity) of the study results	
<b>OTHER INFORMATION</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	

Total score: /30

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

### Additional Checklist

Section / topic	Item #	Recommendation	Reported on page #
Study design	1	The study recruits participants with an actual IQ obtained (i.e. prior to the onset of a dementia and, for healthy controls, prior to the study being commenced)	
Participants	2	(a) Clearly specifies which diagnostic criteria was applied for participants with a dementia AND <i>Where a control group is recruited</i> , screening for cognitive impairment is detailed using a validated instrument e.g. MMSE, ACE-III	/1
		(b) Criteria used is a “gold standard” e.g. NINDS – AIREN, ICD-10, neuro-imaging	
		(c) Dementia subtypes are identified e.g. Alzheimer’s, vascular	
		(d) Severity levels are differentiated and categorised	
		(e) Severity levels are differentiated using a validated instrument e.g. MMSE	
	3	(a) Exclusion criteria are specified	
		(b) Exclusion criteria include: (i) history of stroke (which has resulted in aphasia) (ii) language disorders and aphasias (iii) English not as first language (iv) current psychiatric disorder (v) head trauma (vi) drug/alcohol abuse (vii) other neurological disorders	/7

	4	The sample size is large enough to detect a moderate effect size	
Statistical methods	5	Data has been checked for normal distribution and appropriate parametric or non-parametric tests have been utilised	
Bias	6	<p>Variables specifically considered and statistically explored for sources of bias are:</p> <p>(a)age (b)gender (c)years of education (d)occupational status (e)social class</p> <p>OR</p> <p>For matched studies, there a specific reference to matching of:</p> <p>(a)age (b) gender (c)years of education (d) occupational status (e) social class</p>	/5
Results	7	Effect sizes are reported	

Total score: /22

Strobe checklist: /30

Additional Checklist: /22

Total: /52

#### Appendix 1.4: References of excluded studies

- 1) Baddeley, A., Emslie, H., & Nimmo-Smith, I. (1993). The Spot-the-Word test: A robust estimate of verbal intelligence based on lexical decision. *British Journal of Clinical Psychology*, 32(1), 55-65.  
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- 7) Bucks, R. S., Scott, M. I., Pearsall, T., & Ashworth, D. L. (1996). The short NART: Utility in a memory disorders clinic. *British Journal of Clinical Psychology*, 35(1), 133-141. doi:10.1111/j.2044-8260.1996.tb01168.x.

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- 11) Conway, S. C., & O'Carroll, R. E. (1997). An evaluation of the Cambridge Contextual Reading Test (CCRT) in Alzheimer's disease. *British Journal of Clinical Psychology*, 36(4), 623-625.  
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## Appendix 1.5: Demographics of included studies

Studies are listed and numbered in order of methodological quality. Full references can be found in Appendix 1.4, with associated numbers. Study numbers in the results section correspond to numbers listed in this table.

Study #	Rating	Reading test(s)	Comparator (VIQ or Demographic equation)	Inclusion / exclusion criteria?	Sample size	No. of males	Diagnostic criteria ( <i>Diagnosis</i> )	Severity level assessed?	Mean age (SD)	Mean years of Ed. (SD)
1. McFarlane, Welch and Rodgers (2006)	39/52	NART WTAR CCRT STW	Demographic equation (Crawford and Allan, 1997)	Exc: depression, stroke, head injury, alcohol abuse	Controls = 32 (M)	13	MMSE <28	MMSE <28	70 (10.8)	12.1 (2.9)
					Minimal = 30	14	NINCDS / ADRDA (AD)	MMSE 24-28	73.6 (10.6)	12.2 (2.9)
					Mild = 36	19		MMSE 14-23	75.6 (10.7)	10.6 (2.4)
2. McGurn <i>et al</i> (2004)	34/52	NART	MHT	Inc: people from SMS1932	Controls = 464	U/K	MMSE $\leq$ 24	N/A	79.1 (0.6)	U/K
					Dementia = 45	U/K	ICD-10 (AD, VD, <i>Unspecified</i> & <i>Possible AD</i> )	Mostly mild to moderate on MMSE	79.0 (1.5)	U/K
3. Paolo, Troster, Ryan and Koller (1997)	33/52	NART	WAIS-R VIQ Demographic equation (Barona <i>et al</i> ,	Exc: stroke, psychiatric disorder, head trauma, drug / alcohol abuse,	Controls = 44 (M)	(M)	DRS > 130	DRS > 130	U/K (M)	U/K (M)
					Mild = 24	22 in total	NINCDS / ADRDA	DRS 110-130	74.0 (5.7)	12.7 (2.7)

			1984)	other neuro	Mod = 20		(AD)	DRS < 110	74.2 (7.0)	13.2 (3.4)
4. O'Carroll <i>et al</i> (1995)	27/52	NART	Demographic equation (Crawford <i>et al</i> , 1989)	U/K	Min = 9	4	NINCDS / ADRDA (AD)	MMSE 24-30	65.0 (U/K)	9.8 (U/K)
					Mild = 46	13		MMSE 14-23	74.6 (U/K)	10.6 (U/K)
					Mod = 13	3		MMSE 2-13	71.2 (U/K)	10.5 (U/K)
5. Hart, Smith and Swash (1986)	25/52	SGWR T NART	WAIS VIQ WAIS Vocab	Clinical & lab tests to exclude other neuro, psychiatric, metabolic or systemic conditions	Controls = 15	6	U/K	U/K	69.5 (6.4)	9.3 (1.0)
					AD = 20	12	CT scan Ischaemic score (AD)	Blessed <i>et al</i> (1968) 37-item test	66.3 (6.3)	9.6 (1.1)
6. Stebbins <i>et al</i> (1990b)	24/52	NART	Demographic equation (Wilson <i>et al</i> , 1978)	U/K	Controls = 26 (M)	U/K	MMSE normal range	MMSE normal range	63.5 (U/K)	13.3 (U/K)
					Very mild = 41	U/K	NINCDS / ADRDA (AD, VD,	MMSE 24-27	69.8 (U/K)	12.8 (U/K)
					Mild = 81	U/K		MMSE 16-23	72.9 (U/K)	12.6 (U/K)

					Mod/ Sev = 77	U/K	<i>mixed AD/VD)</i>	MMSE 5-15	72.2 (U/K)	12.4 (U/K)
7. Maddrey <i>et al</i> (1996)	24/52	NART-R	WAIS-R VIQ	U/K	Mild = 19	9	NINCDS / ADRDA (AD)	DRS > 115	74.3 (8.4)	13.7 (3.2)
					Mod = 19	7		DRS 100- 115	71.6 (9.0)	13.8 (3.5)
					Sev = 16	7		DRS < 100	74.4 (10.0)	13.9 (4.2)
8. Crawford, Parker and Besson (1988)	23/52	NART	WAIS Vocab	Glen & Christie's (1979) exclusion criteria  Controls excluded if neuro conditions, head injury or alcohol abuse	Controls = 14 & 8 (M)	(M)	Screened- interview	None	(M)	(M)
					AD = 14 <i>Severe impairment</i>	U/K	NMR imaging, blood flow imaging  (AD & VD)	Age- graded scaled scores	68.7 (U/K)	10.3 (U/K)
					VD = 8 <i>Severe impairment</i>	U/K		Age- graded scaled scores	66.4 (U/K)	9.3 (U/K)
9. Bright, Jaldow & Kopelman (2002)	22/52	NART NART-R	Demographic equations (Crawford <i>et al</i> , 1989; Crawford & Allan, 1997)	Excluded if perceptual difficulties or aphasia	Controls = 51 total (2 studies): 8 (M) 16 (M)	2 (M) 7 (M)	U/K	None	Total = 55.4 (16.0) 66.3 (M) 61.8(M)	Total = 11.2 (2.6) U/K U/K

					AD = 32 total (from 2 studies): 16 AD 16 AD	4 5	CT scan, history, psycho- metrics (AD)	None	65.6 68.7	U/K U/K
10. McCarthy, Burns & Sellers (2005)	22/52	WRAT- R WRAT- 3 NART- R	Demographic equation (Barona <i>et al</i> , 1984)	Exc: psychiatric disorder, drug / alcohol abuse, stroke, comorbid conditions eg VD	Controls = 60	U/K	Screened- interview	None	75.5 (6.0)	13.2 (2.4)
					Mild = 30	Total males = 54	NINCDS / ADRDA & DSM-III-R (AD)	MMSE 20-25	76.4 (5.1)	12.8 (2.9)
					Mod = 30			MMSE 14-19	76.5 (4.9)	12.8 (2.8)
11. Stebbins <i>et al</i> (1990a)	19/52	NART	Demographic equation (Wilson <i>et al</i> , 1978)	Exc: mod/sev dementia evidenced by MMSE < 16	No Language disturbance = 25	U/K	NINCDS / ADRDA (AD, VD and mixed AD/VD)	MMSE 16-23	U/K	U/K
					Naming or Fluency disturbance = 29	U/K		MMSE 16-23	U/K	U/K
					Naming and fluency disturbance = 14	U/K		MMSE 16-23	U/K	U/K
12. O'Carroll, Baikie &	18/52	NART	MHVS	U/K	Dementia = 30	8	DSM-III	None	[Pearsons <i>r</i> matrix	[Pears ons <i>r</i>

Whittick (1987)							<i>(Diagnoses unspecified)</i>		on all variables]	matrix on all variables]
13. Paque & Warrington (1995)	17/52	NART	WAIS-R VIQ	Inc: must have been tested x 2 on NART and x 1 on WAIS	AD = 57	40	U/K (AD)	None	60.5 (9.5)	U/K
14. Johnstone <i>et al</i> (1996)	13/52	WRAT-R NAART	WAIS-R VIQ	Exc: aphasic, learning disability or could not complete tests	AD = 37	28	NINCDS / ADRDA (AD)	U/K	64.35 (12.9)	12.5 (3.5)
15. O'Carroll & Gilleard (1986)	13/52	NART	MHVS	U/K	Dementia = 30	8	DSM-III <i>(Diagnoses unspecified)</i>	None	[Pearsons <i>r</i> matrix on all variables]	[Pearsons <i>r</i> matrix on all variables]
16. Taylor (1999)	12/52	NART	Demographic equation (Crawford <i>et al</i> 1990)	Exc: Dyslexia, aphasia, unable to accurately record demo variables, uncorrected sight/hearing issues, disability, infections, head injury, alcohol abuse, psychiatric	Dementia = 84 (43 AD, 41 VD)	41	NINCDS, Ischaemic score (AD & VD)	None	72.6 (10.7)	U/K



17. Ruddle & Bradshaw (1982)	11/52	SGWR T	WAIS VIQ	U/K	Controls = 78	46	U/K	U/K	39.2 (19.3)	U/K
					Dementia = 22	U/K	U/K	None	64.3 (14.6)	U/K
18. Nelson & McKenna (1975)	8/52	SGWR T	WAIS VIQ WAIS Vocab	U/K	Controls = 98	U/K	U/K	U/K	47.2 (14.5)	U/K
					Dementia = 45	U/K	U/K ( <i>Diagnoses unspecified</i> )	U/K	49.0 (14.5)	U/K

#### Table Key

AD = Alzheimer's disease; VD = Vascular dementia

U/K – Unknown; (M) = Matched

NART (-R) = National Adult Reading Test(-Revised)

NAART = North American Adult Reading Test

WRAT(-R;-3) = Wide Range Achievement Test(-Revised; 3) Reading subtest

WAIS(-R) = Wechsler Adult Intelligence Scale(-Revised)

WAIS Vocab = WAIS Vocabulary subtest

SGWRT = Schonell Graded Word Reading Test

WTAR – Wechsler Test of Adult Reading

NINCDS / ADRDA = National Institute of Neurological and Communicative Disorders and Stroke / Alzheimer's Disease and Related Disorders Association

STW = Spot The Word

CCRT = Cambridge Contextual Reading Test

MHVS = Mill Hill Vocabulary Scale

MHT = Moray House Test (No. 12)

WAIS VIQ = WAIS Verbal IQ

MMSE = Mini Mental State Examination

DRS = Dementia Rating Scale

ICD-10 = International Classification of Diseases (Tenth Edition)

DSM III (-R) = Diagnostic and Statistical Manual III(-Revised)

Exc: = Excluded; Inc: = Included

Min = Minimal; Mod = Moderate; Sev = Severe

## Appendix 2.1: Publication 'Instructions for Authors'

### Author Guidelines

The British Journal of Clinical Psychology publishes original contributions to scientific knowledge in clinical psychology. This includes descriptive comparisons, as well as studies of the assessment, aetiology and treatment of people with a wide range of psychological problems in all age groups and settings. The level of analysis of studies ranges from biological influences on individual behaviour through to studies of psychological interventions and treatments on individuals, dyads, families and groups, to investigations of the relationships between explicitly social and psychological levels of analysis.

The following types of paper are invited:

- Papers reporting original empirical investigations
- Theoretical papers, provided that these are sufficiently related to the empirical data
- Review articles which need not be exhaustive but which should give an interpretation of the state of the research in a given field and, where appropriate, identify its clinical implications
- Brief reports and comments

#### 1. Circulation

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The word limit for papers submitted for consideration to BJCP is 5000 words and any papers that are over this word limit will be returned to the authors. The word limit does not include the abstract, reference list, figures, or tables. Appendices however are included in the word limit. The Editors retain discretion to publish papers beyond this length in cases where the clear and concise expression of the scientific content requires greater length. In such a case, the authors should contact the Editors before submission of the paper.

#### 3. Submission and reviewing

All manuscripts must be submitted via <http://www.editorialmanager.com/bjcp/>. The Journal operates a policy of anonymous peer review. Before submitting, please read the [terms and conditions of submission](#) and the [declaration of competing interests](#).

#### 4. Manuscript requirements

- Contributions must be typed in double spacing with wide margins. All sheets must be numbered.
- Manuscripts should be preceded by a title page which includes a full list of authors and their affiliations, as well as the corresponding author's contact details. A template can be downloaded from [here](#).
- The main document must be anonymous. Please do not mention the authors' names or affiliations (including in the Method section) and refer to any previous work in the third person.
- Tables should be typed in double spacing, each on a separate page with a self-explanatory title. Tables should be comprehensible without reference to the text. They should be placed at the end of the manuscript but they must be mentioned in the text.

- Figures can be included at the end of the document or attached as separate files, carefully labelled in initial capital/lower case lettering with symbols in a form consistent with text use. Unnecessary background patterns, lines and shading should be avoided. Captions should be listed on a separate sheet. The resolution of digital images must be at least 300 dpi. All figures must be mentioned in the text.
- All papers must include a structured abstract of up to 250 words under the headings: Objectives, Methods, Results, Conclusions. Articles which report original scientific research should also include a heading 'Design' before 'Methods'. The 'Methods' section for systematic reviews and theoretical papers should include, as a minimum, a description of the methods the author(s) used to access the literature they drew upon. That is, the abstract should summarize the databases that were consulted and the search terms that were used.
- All Articles must include Practitioner Points – these are 2–4 bullet points to detail the positive clinical implications of the work, with a further 2–4 bullet points outlining cautions or limitations of the study. They should be placed below the abstract, with the heading 'Practitioner Points'.
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## 5. Brief reports and comments

These allow publication of research studies and theoretical, critical or review comments with an essential contribution to make. They should be limited to 2000 words, including references. The abstract should not exceed 120 words and should be structured under these headings: Objective, Method, Results, Conclusions. There should be no more than one table or figure, which should only be included if it conveys information more efficiently than the text. Title, author name and address are not included in the word limit.

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## **Appendix 2.2: Major Research Proposal**

### **Major Research Proposal**

**Assessing the robustness of the TOPF as a measure of premorbid  
intelligence in the Alzheimer's and Vascular dementias**

Matriculation number: 2058546

Trainee: Alexa McDonald

Research supervisor: Professor Jon Evans

Field supervisor: Dr. Stephanie Crawford

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## **Abstract**

Estimation of premorbid intelligence is a crucial component of neuropsychological assessment, providing an accurate baseline from which to identify cognitive decline. Three approaches may be utilised by clinicians: demographic-based regression equations, lexical decision-making tasks and reading exercises. Previous research suggested the National Adult Reading Test (NART, a reading ability test, may not be as accurate in predicting premorbid intelligence as other approaches. The NART has since been replaced with the Test of Premorbid Functioning (TOPF).

This is a cross-sectional design study and the primary objective is to assess the robustness of the TOPF, and compare this with the Spot-the-Word version 2 (STW-2: a lexical decision-making task, and a demographic regression equation in estimating premorbid intelligence in people with Alzheimer's disease (AD), vascular disease (VD) and a mixed Alzheimer's/vascular disease (AVD). The scores of thirty-six probable AD, VD and AVD participants (scoring  $\leq 75$  on the ACE-III) on the TOPF, STW-2 and a demographic equation will be compared with 36 healthy age-matched controls using independent t-tests.

If the TOPF does not provide an accurate estimate of premorbid functioning then this may have implications for clinical use.

## **Introduction**

The early detection of a neurodegenerative disease, such as Alzheimer's, is becoming increasingly important as advances are made in pharmacological and psychological treatments and research suggests that early intervention may be beneficial (The National Audit Office, 2007). Alzheimer's disease is the most common type of dementia, with the National Audit Office estimating that 62% of diagnosed dementias are of the Alzheimer's type, with vascular dementias accounting for around 30%.

NICE (2006) states an assessment of a suspected dementia should be comprehensive and include history taking, a medication review and cognitive, physical and mental examination. Furthermore NICE states that "formal neuropsychological testing should form part of the assessment in cases of mild or questionable dementia" (p.21).

Estimation of premorbid intelligence is now an established and crucial component of neuropsychological assessment, due to the need for an accurate, albeit estimated, baseline from which to identify any cognitive decline. Currently, three approaches may be utilised by clinicians: demographic-based regression equations, lexical decision-making tasks and reading ability.

Reading tasks have become popular in clinical practice and utilise vocabulary level as a correlate to IQ. Such tests rely on the resistance of reading ability to cognitive impairment associated with early stages of most neurodegenerative conditions.

The participant is presented with irregularly spelled words and prompted to pronounce each. The irregular grapheme-to-phoneme translations (such as the



“gh” in the word *rough*) in the words make it difficult to pronounce without previous familiarity. Since participants cannot apply standard pronunciation rules to complete the task, their vocabulary can be assessed by their ability to pronounce the irregularly spelled words, and by extension, estimate their premorbid IQ. However, reading tests are not impervious to the effects of degenerative disease and several studies (e.g. Cockburn, Keene, Hope and Smith, 2000) have demonstrated that reading ability becomes compromised with increasing dementia severity.

Lexical decision tasks measure the ability to classify stimuli (a string of letters) as words or non-words. The “Spot The Word” test is one such task which research (e.g. Yuspeh and Vanderploeg, 2000) suggests is resistant to cognitive impairment and thus provides a useful alternative to reading tests for estimating premorbid intellectual functioning. There is now a second version of this test (STW-2) in which participants are presented with pairs of words, one of which is real and the other a nonsense word. Participants select the real word from the pair and there is no requirement for the word to be pronounced. This task allows decisions to be made through multiple methods including; meaning, familiarity, appearance and sound of words and participants are not penalised for incorrect pronunciation. However, this test also appears to significantly decrease in accuracy with moderate to severe dementias (e.g. Law & O’Carroll, 1998).

Demographic regression equations employ an actuarial approach to the estimation of premorbid ability, using known relationships between demographic variables and performance on intelligence testing. Variables such as age, education and occupation are entered into a regression formula to yield a predicted “IQ” score. One advantage of utilising this method is that data is

gained without the need for testing and is independent of the person's current cognitive functioning, thus remaining constant throughout an individual's lifespan. However, some studies (e.g. Rentz *et al.*, 2004) have demonstrated indices such as education are not always the most accurate estimation of IQ, perhaps as they do not account for intellectual development that may continue throughout life. There are also concerns regarding the accuracy of self-reporting.

Accuracy is limited in all approaches, as shown by Griffin *et al.* (2002) who, in his comparison of methods for predicting IQ, discovered reading tests and demographic equations systematically under or over-estimated IQ. These limitations pose significant challenges for clinicians who require accurate estimations in order to assess the extent of cognitive decline in patients with a dementia. Research in this area continues in order to equip clinicians with the best available evidence regarding the relative strengths and weaknesses of individual and combined approaches and regarding new tests available.

Although reading ability has consistently been demonstrated to be preserved in the early stages of dementia (e.g. McGurn *et al.*, 2004), McFarlane, Welch and Rodgers (2006) found a demographic estimation (based on a regression equation) and a lexical decision-making task ("Spot the Word" test) provided a higher estimate than the National Adult Reading Test (NART) for participants with mild Alzheimer's. The study also found that the Wechsler Test of Adult Reading (WTAR) was more robust than the NART, however it did underestimate IQ in participants with mild Alzheimer's.

The Test of Premorbid Functioning (TOPF) was developed by Wechsler in 2011 and is an updated version of the WTAR. The TOPF is standardised with the

Wechsler Adult Intelligence Scale Fourth Edition (WAIS-IV). As the TOPF is a relatively new test there has yet to be any study conducted to assess its performance as a reading test against the other forms of estimating premorbid intelligence levels.

### **Aims and hypotheses**

The principle aim of this study is to provide a follow-up to McFarlane, Welch and Roger's (2006) study, exploring the robustness of the relatively new TOPF and STW-2 against a demographic estimate (based on a regression equation). The new measures will be explored in the context of Alzheimer's dementia (AD), Vascular dementia (VD) and mixed Alzheimer's and Vascular dementia (AVD). As it is well documented (e.g. Taylor, 1999; Cockburn *et al.*, 2000) that reading ability becomes compromised with increasing severity of dementia, the study will focus on those with mild/moderate dementias.

The primary hypothesis for this study is:

Participants with a dementia will have significantly lower scaled scores on a reading test of pre-morbid ability (TOPF) than healthy controls.

Secondary hypotheses are:

- 1) Participants with a dementia will have significantly lower scaled scores on the TOPF than STW-2;
- 2) There will be no more than a medium effect size difference between the scaled scores for participants with a dementia compared with the healthy control group on the STW-2; and

- 3) The discrepancy between a demographic based estimate of pre-morbid IQ and estimates derived from tests of reading ability will be significantly greater for those with dementias than healthy controls.

### **Plan of Investigation**

#### ***Participants***

Participants with a diagnosis of probable AD, VD and AVD will be recruited from within two NHS Older Adult Community Mental Health teams. All participants will have been given a diagnosis by a psychiatrist using ICD-10 criteria. A healthy control group will be recruited from the partners of the participants with a dementia diagnosis, which will provide a match for age and socioeconomic status. Should the person with dementia not have a partner, or if the partner does not wish to or is unable to participate, this will not exclude the person with dementia from participating. In the event there are too few participants in the healthy control group, NHS staff will identify other potential participants and a pathway has been developed for this recruitment. Where partners attend appointments with the person with dementia, staff can approach these partners directly. For NHS patients whose partners don't attend appointments, NHS staff can provide the patient with information to take home to their partner. Where possible, partners will be identified who are similar in age and socioeconomic status to those participants in the dementia group whose partner did not participate.

#### ***Inclusion and Exclusion Criteria***

Inclusion criteria will include participants (up to the age of 84) with a diagnosis

of probable AD, VD and AVD (mild to moderate) and their partners. The age cut-off of 84 was chosen as this is the maximum age for the STW-2 normative data (the TOPF being 89). Participants will be recruited into the dementia group if their score on the Addenbrooke's Cognitive Examination III (ACE-III) is 75 or below; their partners will be recruited into the healthy group if their ACE-III score is 88 or above (see Appendix A for explanation of score ranges).

Exclusion criteria will be participants who

- have visual or auditory difficulties (which cannot be corrected with the use of glasses or hearing aids);
- a history of stroke, head injury or chronic alcohol use (where this has lead to a degree of aphasia);
- have a diagnosed or suspected learning difficulty such as dyslexia;
- those whose first language is not English; and
- those with other types of dementia or where their dementia has resulted in aphasia

### ***Recruitment Procedures***

Potential participants will be given written information about the study via their psychiatrist, CPN or Link Worker, as part of the twelve-month post diagnostic support offered to all newly diagnosed patients (Scottish Government, 2013). If interested, they will complete the opt-in slip (consenting to be contacted) with the clinician who will send this to the researcher. They will then be provided with further written information about the study. The researcher will then contact the potential participants who will be provided with the opportunity to discuss the study further and ask questions. If potential participants agree to participate,

they be will be asked to sign a consent form. All information provided will be in size 16 font to ensure ease of reading for those with visual impairments.

### ***Measures***

The Test of Premorbid Functioning (TOPF) is a short reading test which provides an estimation of intelligence and is the revised and updated version of the Wechsler Test of Adult Reading (WTAR). As reading ability is thought to be preserved in early dementia, the test is utilised in clinical practice to assess premorbid intelligence levels in people with a diagnosed or suspected dementia. The test is comprised of 70 words with irregular grapheme to phoneme translations, making pronunciation difficult without previous familiarity.

The Spot-The-Word (second edition) test estimates premorbid intelligence through the use of a lexical decision task. Individuals are presented with pairs of items comprising one real word and one nonsense word and are required to identify the real word. Individuals are not required to pronounce the words, merely point out the real words, thus requiring familiarity but not necessarily the ability to pronounce correctly.

The ACE-III is a brief cognitive screening tool which can identify signs of cognitive decline. The tool assesses attention, memory, verbal fluency, language and visuospatial abilities. Scored out of 100, healthy individuals are expected to score 88 or above; below this score is indicative of cognitive decline. Participants with a dementia will be included if their ACE-III score is 75 or below and their partners will be included if their ACE-III score is 88 or above. Explanation for these ranges can be found in Appendix A. Such ranges are

required in this study in order to ensure only participants with a definite dementia are included, and that the “healthy” group are indeed free from any neurodegenerative disease.

All participants will be administered the ACE-III, TOPF and the STW-2 test. If a participant has already completed any of these within the last six months, permission will be sought to use those results.

### ***Design***

In this cross sectional study there will be two groups (a healthy group and a dementia group) of participants each of whom will be assessed on three measures of premorbid ability (TOPF, STW-2 and demographic equation). There will be a comparison of the discrepancies in scores between these groups on the measures. Demographic information will be sought from all participants including age, gender, years of education, occupational status and level of socioeconomic deprivation, which will be determined using the Scottish Index of Multiple Deprivation (SIMD). The SIMD measures deprivation in terms of employment, income, health, education, access to services, crime, and housing and assigns each postcode a ranked score based on these factors.

Although there is some risk of misclassification, all participants will be asked for their years of education and occupational status (or previous occupation if retired) and compare these with the results of the SIMD. Furthermore, due to the generation of participants being investigated, it is less likely that issues of social mobility will influence the results. Previous studies (e.g. Crawford & Allan, 1997; Crawford *et al*, 1989) suggest participants should be credited with 0.5

years of education for every year of part-time education (which led or was leading to a formal qualification), which will be used in this study.

### ***Data analysis***

Independent t-tests will be used for comparing the discrepancy scores of the groups. The groups will be matched on variables such as age, socioeconomic status (etc) through recruiting partners as the healthy group. Although this is not guaranteed to provide an exact match for all variables, this study is interested in the discrepancy scores between different measures and this will be evident (if present) regardless of any demographic differences.

A multiple regression analysis will be used to predict participants' premorbid intelligence based on demographic information and will be compared against scores on the TOPF and STW-2. The demographic equation will be entered into Crawford and Allan's (1997) regression equation:

$$\text{Predicted FSIQ} = 87.14 - (5.21 \times \text{occupation}) + (1.78 \times \text{years of education}) + (0.18 \times \text{age})$$

In line with the regression equation, "occupation" will be classified into 5 categories: 1 = professional; 2 = intermediate; 3 = skilled; 4 = semi-skilled; and 5 = unskilled. Individuals who are retired, unemployed or who are housewives/husbands will be categorised according to their previous occupation. Those who have never worked will be classified as unskilled (code 5).

Updated regression equations have not been published to convert TOPF-



estimated IQ to the newer normative samples of the WAIS-IV, however Crawford and Allan's (1997) equation was utilised in McFarlane, Welsh and Rodgers (2006) study.

Secondary analyses will be conducted on the main hypotheses by comparing the results of those with a diagnosis of a dementia of the Alzheimer's type and those with a diagnosis of vascular dementia. Furthermore, there will be an exploration as to whether different combinations of results (performance tests plus demographic variables) provide a better estimation of IQ, in terms of providing a better match with the control group.

### ***Justification of sample size***

When comparing performance of people with mild dementia and healthy controls, McFarlane et al. (2006) examined three different reading based measures and the average effect size of the differences between these groups was  $d=0.67$  (medium-large). This was therefore used as the basis for estimating the sample size for the proposed study. In the proposed study independent t-tests will compare the two groups (healthy controls and dementia groups), hence the effect size measure used as Cohen's  $d$  (for which a medium-large size is  $d = 0.6$ ). A "G-power" analysis confirmed that 72 participants (36 per group) will be required, based on the following:

- effect size of  $d = 0.6$
- alpha level of 0.05
- power level of 0.8

Within the NHS sites identified (see below), the number of newly diagnosed (with dementia) patients per quarter ranges from 100 to 150 per quarter (i.e.

three months). Patients with Alzheimer's dementia who are commenced on a cognitive enhancer medication are monitored within the service for a minimum of six weeks and, if the enhancer is to be continued, are monitored thereafter every six months. All patients diagnosed with a dementia, regardless of whether medication is prescribed, are also offered 12 months post-diagnostic support from the NHS team.

Therefore recruiting 36 participants with a dementia and 36 partners from people with a dementia from a pool of patients conservatively estimated at 200 should be feasible. This estimate is based on 100 newly diagnosed people per quarter (thus 400 in a 12-month period) and half of these continuing to receive input from the NHS team in some capacity (i.e. medication reviews or psychosocial support).

### ***Settings and Equipment***

Participants will be seen in NHS clinics whenever possible and permission has been granted to conduct home visits, due to the population being studied. The clinics will be NHS Greater Glasgow and Clyde Older Adults Community Mental Health clinics. There will be two sites included in the study which will be Eastwood Resource Centre and Park View Resource Centre.

Equipment required will be paper, and recording forms for the ACE-III, TOPF, STW-2. SPSS (v19) will be used for the analyses and a University of Glasgow encrypted laptop with the SPSS license will be sourced.

## **Health and Safety Issues**

Where participants are seen in an NHS clinic, there will be minimal health and safety issues for either researcher or participants. However, due to the population being studied, issues of mobility and transport difficulties are common, and standard clinical practice involves staff conducting home visits in order to provide an equitable service. Therefore, permission has been granted to offer home visits where necessary in order to allow people with such difficulties to still participate. All participants requiring a home visit will have been thoroughly risk assessed by trained staff in the community mental health teams. Local and national policy guidelines on health and safety and emergency procedures (e.g. lone working policy, fire safety) will be sought. Where lone visits are conducted, appropriate measures to ensure safety will be implemented, such as ensuring the NHS clinic has a record of the name and address of participant(s) being visited and at what time, the use of a fully charged mobile phone which the clinic has the number for, providing the clinic with a time when the visit should be completed by and ringing the office when the visit is completed. In the event that the researcher does not contact the clinic by the specified time, an administrator at the clinic will contact the researcher by mobile. The administrator will also have the contact telephone number of the participant(s) in the event the mobile telephone is not working (e.g. due to a lack of signal). A health and safety assessment form is included in Appendix B. A separate pathway has been developed for dealing with any concerns regarding risk for any participants in the study.

## **Ethical Issues**

Issues of consent and capacity will need careful judgement. Psychiatrists

responsible for the potential participant's care will be consulted as to capacity to consent. All participants will be checked for consent on the day of assessment. As this study is only recruiting patients with mild/moderate AD/VD/AVD, this should minimise difficulties with capacity to consent in participating. However, where the researcher is unsure, this will be addressed through discussion with the relevant psychiatrist. Where doubt remains, the participant will not be recruited or results not included.

Recruiting healthy controls carries the risk of detecting cognitive difficulties which the participant was previously unaware of. Participants will be made aware of this prior to participating and will be given the option of discussing their results or not. Where the participant has any concerns regarding their test performance, this will be discussed and the participant will be directed to their G.P.

No patient identifiable information will be sought and all information recorded will be on a university encrypted laptop. The data will be backed up on an encrypted memory stick. Paper copies of completed tests and consent forms will be stored in accordance with local and national Data Protection guidelines, and will be stored in a locked filing cabinet within NHS premises. The researcher and Chief Investigator will have access to the data and upon completion of the study, the Chief Investigator will retain the data. This will be held within the Institute of Mental Health and Wellbeing at the University of Glasgow (Gartnavel Royal Hospital) for ten years. Paper files containing personal information used to contact participants (e.g. name, address) will be destroyed by shredding upon the completion of study.

There will be an application to the NHS Research Ethics Committee who will provide feedback on plans to minimise any adverse effects on participants.

### **Financial issues**

The main bulk of costs involved will be the purchase of the recording forms for the TOPF and STW-2. Full costs are given in Appendix C.

### **Timetable**

Information to OA teams	November 2014
Recruitment of participants	November 2014 – January 2015
Data collection	January 2015 – May 2015
Analysis and write-up	May 2015
Final write-up and preparation for viva	June – July 2015

### **Practical Applications**

The use of reading tests is popular in neuropsychological assessment, which aims to provide a cognitive profile, based on current and premorbid ability. If the TOPF does not provide an accurate estimate of premorbid functioning then this may have implications for its clinical use. This study aims to add to the evidence base by providing up-to-date evidence of the robustness of this new measure as well as the STW-2. Furthermore, should a combined approach (i.e. performance tests plus demographic variables) prove more effective than

performance tests alone, this will provide useful information for clinicians practising in the field.

### **Dissemination of results**

Once the thesis is completed it will be submitted to the University of Glasgow as part fulfilment of the award of Doctorate in Clinical Psychology. The researcher will explore appropriate academic journals with the academic supervisor and submit for publication. Participants will be given the option of receiving a summary sheet of the findings of the study. This will be discussed with them when the researcher completes the consent form.

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## Appendix 2.3: Ethics approval letter

**WoSRES**  
**West of Scotland Research Ethics Service**

*Letter corrected as per email from Investigator*



**West of Scotland REC 3**  
Ground Floor – The Tennent Institute  
Western Infirmary  
38 Church Street  
Glasgow G11 6NT  
[www.nhsggc.org.uk](http://www.nhsggc.org.uk)

Professor Jonathan Evans  
Mental Health and Wellbeing  
University of Glasgow  
The Academic Centre  
Gartnavel Royal Hospital  
1055 Great Western Road  
Glasgow G12 0XH

Date 16<sup>th</sup> January 2015  
Your Ref  
Our Ref  
Direct line 0141 211 2123  
Fax 0141 211 1847  
E-mail [WOSREC3@ggc.scot.nhs.uk](mailto:WOSREC3@ggc.scot.nhs.uk)

Dear Professor Evans

<b>Study title:</b>	<b>Assessing the robustness of the Test of Premorbid Function (TOPF) in estimating premorbid intelligence in Alzheimer's and Vascular dementias</b>
<b>REC reference:</b>	<b>14/WS/1144</b>
<b>IRAS project ID:</b>	<b>159617</b>

Thank you for your letter of , responding to the Committee's request for further information on the above research and submitting revised documentation.

The further information was considered in correspondence by a Sub-Committee of the REC. A list of the Sub-Committee members is attached.

We plan to publish your research summary wording for the above study on the HRA website, together with your contact details. Publication will be no earlier than three months from the date of this favourable opinion letter. The expectation is that this information will be published for all studies that receive an ethical opinion but should you wish to provide a substitute contact point, wish to make a request to defer, or require further information, please contact the REC Manager, Mrs Liz Jamieson, [wosrec3@ggc.scot.nhs.uk](mailto:wosrec3@ggc.scot.nhs.uk). Under very limited circumstances (e.g. for student research which has received an unfavourable opinion), it may be possible to grant an exemption to the publication of the study.

### **Confirmation of ethical opinion**

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised, subject to the conditions specified below.

### **Conditions of the favourable opinion**

The favourable opinion is subject to the following conditions being met prior to the start of the

study.

Management permission or approval must be obtained from each host organisation prior to the start of the study at the site concerned.

*Management permission ("R&D approval") should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements.*

Guidance on applying for NHS permission for research is available in the Integrated Research Application System or at <http://www.rdforum.nhs.uk>.

*Where a NHS organisation's role in the study is limited to identifying and referring potential participants to research sites ("participant identification centre"), guidance should be sought from the R&D office on the information it requires to give permission for this activity.*

*For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.*

*Sponsors are not required to notify the Committee of approvals from host organisations*

**It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).**

#### **Ethical review of research sites**

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" below).

#### **Approved documents**

The final list of documents reviewed and approved by the Committee is as follows:

<i>Document</i>	<i>Version</i>	<i>Date</i>
Covering letter on headed paper [Covering letter for amendments]	1	16 December 2014
GP/consultant information sheets or letters [GP notification letter_30th September 2014_Version 2]	2	30 September 2014
GP/consultant information sheets or letters [GP and CMHT information sheet]	3	15 December 2014
Letters of invitation to participant [Letter of invitation a: For people with a dementia]	3	15 December 2014
Letters of invitation to participant [Letter of invitation b: For partners of a person with a dementia]	1	12 December 2014
Other [University approval letter_27th August 2014_Version 1]	1	27 August 2014
Other [Incidental findings within the control group]	1	12 December 2014
Other [Pathway for dealing with issues of risk]	1	12 December 2014
Other [Recruitment of health controls]	1	12 December 2014
Participant consent form [Participant consent form a: For people with a dementia]	3	09 December 2014
Participant consent form [Participant consent form b: For partners of a person with a dementia]	1	09 December 2014
Participant information sheet (PIS) [PIS_30th September 2014_Version 2]	2	30 September 2014
Participant information sheet (PIS) [PISa: For people with a dementia]	3	09 December 2014
Participant information sheet (PIS) [PISb: For partners of a person]	1	09 December 2014

with a dementia]		
REC Application Form [REC_Form_07112014]		07 November 2014
Research protocol or project proposal [Protocol 27th October 2014 Version7]	8	12 December 2014
Summary CV for Chief Investigator (CI) [EVANS Jonathan CV 2nd September 2014]	1	02 September 2014
Summary CV for supervisor (student research) [CRAWFORD Stephanie CV 30th September 2014]	1	30 September 2014
Validated questionnaire [TOPF Administration_2010_Version 1]	1	05 November 2014
Validated questionnaire [TOPF Front Sheet_2010_Version 1]	1	05 November 2014
Validated questionnaire [TOPF Reading card_2010_Version 1]	1	05 November 2014
Validated questionnaire [TOPF Scoring card_2010_Version 1]	1	05 November 2014
Validated questionnaire [STW Administration Sheet_2012_Version 2]	2	05 November 2014
Validated questionnaire [STW Reading card sample_2012_Version 2]	2	05 November 2014
Validated questionnaire [STW Reading card sample_2012_Version 2]	2	05 November 2014
Validated questionnaire [STW2 Front Sheet_2012_Version 2]	2	05 November 2014
Validated questionnaire [ACE III Administration (UK)_2012_Version A]	A	05 November 2014
Validated questionnaire [ACE III Front Sheet_2012_Version A]	A	05 November 2014
Validated questionnaire [ACE III Sample Sheet_2012_Version A]	A	05 November 2014

### Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

### After ethical review

#### Reporting requirements

The attached document "*After ethical review – guidance for researchers*" gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Notification of serious breaches of the protocol
- Progress and safety reports
- Notifying the end of the study

The HRA website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

### User Feedback

The Health Research Authority is continually striving to provide a high quality service to all applicants and sponsors. You are invited to give your view of the service you have received and the application procedure. If you wish to make your views known please use the feedback form available on the HRA website:

<http://www.hra.nhs.uk/about-the-hra/governance/quality-assurance/>

## HRA Training

We are pleased to welcome researchers and R&D staff at our training days – see details at <http://www.hra.nhs.uk/hra-training/>

**14/WS/1144**

**Please quote this number on all correspondence**

With the Committee's best wishes for the success of this project.

Yours sincerely



**Liz Jamieson**  
**REC Manager**  
**On behalf of Dr Adam Burnel, Chair**

Enclosures: List of names and professions of members who were present at the meeting

"After ethical review – Guidance for Researchers"

Copy to: Ms Emma-Jane Gault, University of Glasgow  
Mrs Elaine O'Neill, NHS Greater Glasgow and Clyde  
Mrs Alexa McDonald (Student)

**West of Scotland REC 3**

**Sub-Committee of the REC meeting – deadline 19 December 2014**

**Committee Members:**

<i>Name</i>	<i>Profession</i>	<i>Present</i>	<i>Notes</i>
Dr Adam Burnel	Consultant Psychiatrist - Chair	Yes	
Ms Catriona Kent	Nurse Consultant	Yes	
Mr Eoin MacGillivray	Retired Dentist - Vice Chair	Yes	

**Also in attendance:**

<i>Name</i>	<i>Position (or reason for attending)</i>
Mrs Rose Gallacher	Assistant Co-ordinator