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Concurrent validity of the TOMM and LNNB

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Abstract

An archival search was done to find adults who were given the Test of Memory Malingering (TOMM) and the Luria-Nebraska Neuropsychological Battery (LNNB), both neuropsychological tests, in order to compare the outcomes and refine the interpretation of the TOMM and validity formula for the LNNB. The two malingering measures agreed 89.3% of the time, and people with serious cognitive disorders were able to pass them. No single rationale, including a serious memory disorder, accounts for the remaining 11%.

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The need to test for effort in doing neuropsychological evaluations is well documented (Faust, Ziskin, & Hiers, 1991; Gervais, Rohling, Green, & Ford, 2004; Rogers, 1988). Put simply, our patients don't always do their best on our tests, which affects the validity of the results. Procedures have been developed to check the validity of an evaluation, and include both stand-alone tests and within-test formulas. Stand-alone tests are developed specifically to detect malingering, and usually feature high accuracy rates. They can be easily spotted, though, involve an extra procedure, and only test malingering within one domain (such as memory). Within-test formulas cannot be spotted and need no special procedure added to the test, but are usually less accurate.

The Test of Memory Malingering (TOMM) (Tombaugh, 1996, 1997) is a stand-alone test for neuropsychological malingering. It features acceptable cross-validated accuracy rates (9% false negative rate & 2% false positive rate)[1] (Rees, Tombaugh, Gansler, & Moczynski, 1998), only takes 10 minutes, and is portable. However, the false positive rate is known to be higher in people with serious dementias (Teichner & Wagner, 2004; Tombaugh, 1996, 1997)—not surprising, since the test consists of recognizing 50 simple pictures both immediately and after a 15 minute delay. Just how serious the dementia must be to affect the false positive rate is unknown, since the test has not yet been compared either to true tests of memory or to comprehensive neuropsychological batteries.

The within-test formula developed for the Luria-Nebraska Neuropsychological Battery (LNNB) (Golden, Purisch, & Hammeke, 1995; McKinzey, Podd, Krehbiel, Mensch, & Trombka, 1997), has acceptable (albeit lower) cross-validated accuracy rates (17% false negative rate and 5% false positive rate). The LNNB validity formula (LVF) uses scattered items, given as usual, across different domains (rather than just memory), so the entire battery's validity can be checked objectively. How the TOMM's outcomes will compare to the LNNB's outcomes is unknown.

We have done an archival search of patients who were given both the TOMM and LNNB. We compared the results of the TOMM to a) the severity of LNNB profile b) the results of the 3 memory scales within the LNNB c) the outcome of the LNNB's validity formula and d) demographic variables.

Method

Patients: The 76 patients came from two settings that routinely used the TOMM and LNNB. From the National Naval Medical Center (NNMC) came adults who had taken the tests as part of a clinical, prescribed regimen of diagnostic testing. From the senior author's forensic private practice came adults who had taken the TOMM and LNNB as part of their legal cases. The sample was 72% male, 93% right handed, and 75% white. The sample's mean age was 50 years (range 18-82,

[1] For definitions of accuracy terms associated with the 2x2 table, see: http://wpe.info/2x2table.pdf.

SD = 19.6) and mean education was 14 years (range 6-22, *SD* = 3). The samples' final neurological diagnoses included No Disorder (12), Amnestic Disorder (5), Anxiety Disorder/PTSD (3), Codeine Intoxication (1), Cognitive Disorder NOS (19), Concussion (8), Dementia (21), and Depressive Disorder (7). From the NNMC came 47 patients, none with any known reason to malinger. Of the 29 patients from the forensic sample, 16 were in civil proceedings, and 13 in criminal proceedings.

Procedure: This is an archival study. After the tests were given and scored, the data from the TOMM (Trials 1-3) were collected and added to the raw item scores and scale scores of the LNNB. The various results are then compared.

Materials: The TOMM consists of 50 pen and ink pictures that were found to be easily remembered and recognized. The pictures are presented individually at a 3" pace. In Trial 1, the same pictures are again presented immediately, this time paired with another pen and ink picture not in the original 50. In a forced choice procedure, the testee is asked to identify the one already seen and told whether the choice is correct. The score consists of number of correctly identified pictures. Trial 2 is then done immediately, and is an identical procedure and list of pictures. Trial 3 (Retention) is given after a 15 minute delay. This time, only the paired pictures are shown, and no correctness feedback is given. A score lower than the validated cutoff on either Trial 2 or Trial 3 is considered positive. Scores lower than chance on either Trial 2 or Trial 3 is considered strong proof of malingering, since such a below chance score can only be obtained if the correct answers are known (Tombaugh, 1996, 1997). The categorical TOMM outcome (positive or negative) can be dummy coded (1 or –1, respectively) to allow correlation calculations.

The LNNB is a comprehensive neuropsychological battery. It consists of 269 behavioral neurology items selected for their sensitivity to specific cortical dysfunctions. It can therefore test a wide range of cortically-based intellectual functions in one, 3-4 hour sitting and compare a large number of psychometrically established scales to established age and education corrected norms. The overall severity of scale and profile elevations can be summarized by using the Luria-Nebraska Impairment Index (LNII) norms (Johnson, Moses, & Bryant, 1984). The LNNB has a 13 item scale consisting of verbal and nonverbal memory behavioral tasks. The entire scale (C10) is then divided into factor-analyzed scales consisting of 5 verbal items (ME1) and 4 visual/complex items (ME2). The LVF compares items empirically (and non-theoretically) chosen as separating true patients from people asked to malinger the test. The formula is not interpreted as positive in normal or very mild (i.e., those with LNII = 1) profiles. The categorical LVF outcome variable can also be dummy coded into a continuous variable to calculate correlations.

Results

All 76 patients were given the LNNB, but only 75 were given at least Trial 2 of the TOMM. As can be seen in Table 1, there was 89.3% agreement between the TOMM and LNNB validity

formula. The two tests were both negative in 66 (88%) patients, and both positive in 1 (1.33%). Six (8%) patients had positive TOMMs, four (5.33%) positive LVF scores. The chi-square was not significant (*chi-square* = 1.66, $p = .19$).

Table 2 reports the correlations of the TOMM and LVF scores with age, education, LNII, C10, ME1, and ME2[2]. All four TOMM scores were significantly correlated with education, LNII, and C10, but not with age, ME1, or ME2 elevations. The LVF was significantly correlated with C10 elevation, but not with LNII, ME1, ME2, age, or education. One patient scored below chance on the TOMM: When this outlier was removed (Table 3), the education and TOMM correlations remained significant only for Trial 3 (Retention). The LNII and TOMM correlations remained significant only for Trial 1 & 2. The C10, LVF, and TOMM correlations remained significant.

41 (54%) of the LNNB profiles were normal as measured by the Mod 5 R Rule (McKinzey, Roecker, Puente, & Rogers, 1998). 24 had LNII in the Mild range, 5 in the Moderate range, and 2 in the Marked range. Of the 7 in these two latter ranges, none had a positive LVF. One (LNII = 4, Marked) had a below chance TOMM, with a negative LVF. 10 of the LNNB profiles had C10 scores in the Moderate range. Of these, 2 had positive TOMM scores. None had positive LVF scores.

Contrary to expectations, of the 6 positive TOMM scores, twice as many came from the clinical NNMC practice, which had only 1.55 times the patients.

Discussion

The TOMM and LVF have high agreement. Of the 75 patients given the two tests, 67 (89.3%) have the same outcome: 66 (88%) negative, 1 (1.33%) positive. Of the 75, 8 (10.6%, hereafter rounded to 11%) get different results: 5 (6.67%) are positive on the TOMM, 3 (4%) are positive on the LVF, without being positive on the other test. It would seem that giving the two effort tests together does not raise the false positive rates to unacceptable levels, and it makes sense to combine a stand-alone measure with a within-test measure, especially one that samples a wide range of domains.

But, how to explain that 11%? There are several possible explanations.

The first possible explanation is that the 11% represent statistically inevitable false positives, TOMM and LVF misses. The 7% TOMM rate is higher than the previously found false positive rate of 2% in normals, but about the same as the 8% found in a similar sample of cognitively impaired patients (Teichner & Wagner, 2004). Likewise, the 4% LVF rate is about the same as the previously found 5% false positive rate in normals.

Surprisingly, the presence of a serious memory disorder does not clearly explain the misses—of the 5 TOMM misses, only 2 had a highly elevated C10 score, and the 3 LVF misses

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[2] The LNII is corrected using the age and education method of calculating the Critical Level. C10, ME1, and ME2 elevations were calculated by subtracting them from the manual's Critical Level described in McKinzey et al. (1998).

had none. By contrast, of the 10 patients with seriously elevated C10 scores, only 2 had a positive TOMM. Confirming Teichner & Wagner (2004), the TOMM and LVF seem to yield acceptable rates, as even people with serious cognitive disorders can pass them.

The presence of a generally elevated profile also does not clearly explain the discrepancies. Of the 7 patients with Moderately to Markedly elevated profiles (i.e., LNII = 3-4), only 2 had positive TOMMs (one with below chance scores!), and none had positive LVFs.

Educational level is also not a satisfactory answer, despite the significant correlations. Of the 2 patients with 6 years of education, both failed the TOMM but not the LVF. One had an elevated C10, with a Retention trial score equal to chance; the other had a Markedly elevated LNNB profile with all TOMM scores less than chance (possible only if the correct answers are known & deliberately ignored). When this latter patient is excluded as an outlier, the correlation of education with TOMM outcome is no longer significant.

Another explanation is that none of the 11% are inaccurate. Paul Green has argued that his Word Memory Test (WMT) has no false positives. In one study (Green & Flaro, 2003), he too found a few positive WMT results in people thought to have no reason to malinger. When these apparent false positives were questioned, all of them were found to be, for various reasons, little involved with the testing. The same may be true for our sample—especially for the one patient (#36, from the clinical sample) that obtained positive scores for both TOMM and LVF.

Considering that both the TOMM and LVF have higher false negative rates than false positive rates, the most likely explanation of disagreement is that one measure is a false negative. This explanation best fits #33, who had both a highly elevated LNNB profile and a below-chance TOMM score, but without a positive LVF. It also explains clinical patient #39 (36 years old, 14 years education), who was referred for memory complaints after a brainstem stroke. Although he obtained positive TOMM scores, he also obtained a completely negative LNNB profile (and, thus, a negative LVF).

A related possibility is suggested by Ladowsky-Brooks and Fischer (2003). Like our sample, they found a patient with little reason to malinger who presented with a clear Ganser syndrome, including a positive TOMM result. Neuroimaging at the time showed only non-specific cortical atrophy, but two years of followup showed a clear, progressive frontal dementia that eventually became profound. They argue that the malingering presentation was due to the disinhibition caused by the deterioration of the frontal lobe. Perhaps our clinical patient #36, with such unconvincing test results without any known reason to malinger, is best diagnosed using the apparently contradictory Factitious Disorder and Personality Change Due to frontal lobe disease!

References

Faust, D., Ziskin, J., & Hiers, J. (1991). *Brain damage claims: coping with neuropsychological evidence*. Los Angeles: Law & Psychology Press.

Gervais, R., Rohling, M., Green, P., & Ford, W. (2004). A comparison of WMT, CARB, and TOMM failure rates in non-head injured disability claimants. *Archives of Clinical Neuropsychology, 19*(4), 475-487.

Golden, C. J., Purisch, A. D., & Hammeke, T. A. (1995). *Luria-Nebraska Neuropsychological Battery: Forms I & II manual*. Los Angeles: Western Psychological Services.

Green, P., & Flaro, L. (2003). Word Memory Test performance in children. *Child Neuropsychology, 9*(3), 189-207.

Johnson, G. L., Moses, J. A., & Bryant, E. (1984). Development of an impairment index for the Luria-Nebraska Neuropsychological Battery. *International Journal of Clinical Neuropsychology, 6*(4), 242-247.

Ladowsky-Brooks, R. L., & Fischer, C. E. (2003). Ganser Symptoms in a Case of Frontal-Temporal Lobe Dementia: Is There a Common Neural Substrate? *Journal of Clinical & Experimental Neuropsychology, 25*(6), 761-768.

McKinzey, R. K., Podd, M. H., Krehbiel, M. A., Mensch, A. J., & Trombka, C. C. (1997). Detection of malingering on the Luria-Nebraska Neuropsychological Battery: An initial and cross-validation. *Archives of Clinical Neuropsychology, 12*(5), 505-512.

McKinzey, R. K., Roecker, C. E., Puente, A. E., & Rogers, E. B. (1998). Performance of normal adults on the Luria-Nebraska Neuropsychological Battery, Form I. *Archives of Clinical Neuropsychology, 13*(4), 397-413.

Rees, L. M., Tombaugh, T. N., Gansler, D. A., & Moczynski, N. P. (1998). Five validation experiments of the Test of Memory Malingering (TOMM). *Psychological Assessment, 10*(1), 10-20.

Rogers, R. (1988). *Clinical Assessment of Malingering and Deception*. New York: The Guilford Press.

Teichner, G., & Wagner, M. (2004). The Test of Memory Malingering (TOMM): Normative data for cognitively intact, cognitively impaired, and elderly patients with dementia. *Archives of Clinical Neuropsychology, 19*(4), 455-464.

Tombaugh, T. N. (1996). *Test of Memory Malingering: TOMM*. Niagara Falls, NY: MHS.

Tombaugh, T. N. (1997). The Test of Memory Malingering (TOMM): Normative data from cognitively intact and cognitively impaired individuals. *Psychological Assessment, 9*(3), 260-268.

Table 1: TOMM & LVF frequencies

	TOMM Negative	TOMM Positive	Totals
LVF Negative	66 (88%)	5 (6.67%)	71
LVF Positive	3 (4%)	1 (1.33%)	4
Totals	69	6	75

Notes: TOMM = Test of Memory Malingering, LVF = LNNB Validity Formula. Percents are of total.

Table 2: Correlations of age, education, LNII, C10, ME1, and ME2 with TOMM and LVF scores, complete sample

	Correlation	Count	Z-Value	P-Value
age, TOMM 1	.11	76	.98	.3262
age, TOMM 2	.12	75	.99	.3214
age, TOMM Ret	.21	60	1.59	.1112
age, TOMM Pos	-.22	75	-1.93	.0535
age, LVF	.01	76	.07	.9470
ed, TOMM 1	.27	76	2.37	.0178
ed, TOMM 2	.31	75	2.68	.0073
ed, TOMM Ret	.44	60	3.61	.0003
ed, TOMM Pos	-.25	75	-2.19	.0287
ed, LVF	.18	76	1.55	.1221
LNII, TOMM 1	-.46	76	-4.22	<.0001
LNII, TOMM 2	-.51	75	-4.78	<.0001
LNII, TOMM Ret	-.51	60	-4.28	<.0001
LNII, TOMM Pos	.25	75	2.2	.0278
LNII, LVF	-.12	76	-1.03	.3028
C10, TOMM 1	-.32	76	-2.82	.0048
C10, TOMM 2	-.28	75	-2.42	.0153
C10, TOMM Ret	-.35	60	-2.75	.0059
C10, TOMM Pos	.29	75	2.54	.0112
C10, LVF	-.28	76	-2.42	.0156
ME1, TOMM 1	-.02	76	-.21	.8369
ME1, TOMM 2	-.16	75	-1.39	.1658
ME1, TOMM Ret	-.17	60	-1.26	.2061
ME1, TOMM Pos	.06	75	.49	.6215
ME1, LVF	.06	76	.5	.6143
ME2, TOMM 1	.09	76	.79	.4312
ME2, TOMM 2	.16	75	1.38	.1683
ME2, TOMM Ret	.09	60	.68	.4950
ME2, TOMM Pos	-.01	75	-.11	.9100
ME2, LVF	.12	76	1.05	.2936

Notes: Age & education are in years. TOMM = Test of Memory Malingering. TOMM 1 = TOMM trial 1. TOMM 2 = TOMM trial 2. TOMM Ret = TOMM trial 3 (retention). TOMM Pos = Errors of either trial 2 or ret greater than cutoff; categorical variable is dummy coded. LNII = Luria Nebraska Impairment Index. LVF = LNNB Validity Formula, dummy coded. C10 = LNNB C10 t-score – Critical Level. ME1 = Verbal Memory Factor Scale t-score – Critical Level. ME2 = Non-Verbal Memory Factor Scale t-score – Critical Level. The calculation of the LNNB Critical Level is described in McKinzey et al. (1998).

Table 3: Correlations of age, education, LNII, C10, ME1, and ME2 with TOMM and LVF scores, minus one outlier

	Correlation	Count	Z-Value	P-Value
age, TOMM 1	.08	74	.69	.4914
age, TOMM 2	.13	74	1.06	.2896
age, TOMM ret	.23	59	1.73	.0843
age, TOMM Pos	-.22	74	-1.87	.0613
age, LVF	.01	74	.11	.9106
ed, TOMM 1	.14	74	1.2	.2310
ed, TOMM 2	.1	74	.82	.4141
ed, TOMM ret	.32	59	2.47	.0136
ed, TOMM Pos	-.15	74	-1.29	.1983
ed, LVF	.17	74	1.45	.1462
LNII, TOMM 1	-.31	74	-2.72	.0066
LNII, TOMM 2	-.37	74	-3.26	.0011
LNII, TOMM ret	-.25	59	-1.94	.0526
LNII, TOMM Pos	.12	74	1	.3167
LNII, LVF	-.12	74	-.98	.3271
C10, TOMM 1	-.29	74	-2.51	.0121
C10, TOMM 2	-.3	74	-2.61	.0091
C10, TOMM ret	-.36	59	-2.81	.0050
C10, TOMM Pos	.26	74	2.22	.0265
C10, LVF	-.27	74	-2.37	.0177
ME1, TOMM 1	.03	74	.28	.7770
ME1, TOMM 2	-.15	74	-1.3	.1919
ME1, TOMM ret	-.12	59	-.94	.3494
ME1, TOMM Pos	.02	74	.19	.8495
ME1, LVF	.06	74	.54	.5910
ME2, TOMM 1	.02	74	.16	.8718
ME2, TOMM 2	.08	74	.71	.4786
ME2, TOMM ret	-.05	59	-.35	.7268
ME2, TOMM Pos	.05	74	.38	.7039
ME2, LVF	.12	74	1	.3187

Notes: Age & education are in years. TOMM = Test of Memory Malingering. TOMM 1 = TOMM trial 1. TOMM 2 = TOMM trial 2. TOMM Ret = TOMM trial 3 (retention). TOMM Pos = Errors of either trial 2 or ret greater than cutoff; categorical variable is dummy coded. LNII = Luria Nebraska Impairment Index. LVF = LNNB Validity Formula, dummy coded. C10 = LNNB C10 t-score – Critical Level. ME1 = Verbal Memory Factor Scale t-score – Critical Level. ME2 = Non-Verbal Memory Factor Scale t-score – Critical Level. The calculation of the LNNB Critical Level is described in McKinzey et al. (1998).