Total Recognition Discriminability in Huntington's and Alzheimer's Disease

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INTRODUCTION

- Recognition discriminability refers to the ability to endorse target items and reject distractor items on a test of recognition memory.
- HD and AD patients perform worse than cognitively healthy adults on multiple measures of verbal learning and memory on the California Verbal Learning Test (CVLT)[1], including recognition discriminability[3,5,8,9,11,13-16].
- Consistent with CVLT-I findings, AD patients exhibit worse recognition discriminability than healthy adults on the CVLT-II[4,6,17].
- There has been no known investigation of CVLT-II performance in HD patients versus healthy adults.
- AD patients perform worse than HD patients on various CVLT-I measures[3,9,10], including recognition discriminability[3,9].
- Additionally, AD patients perform worse than HD patients on CVLT-II subtypes of total and novel recognition discriminability, but comparably on the subtype of source recognition discriminability[7].
- The CVLT-I used a nonparametric formula[12],which yielded a score that reflected the percentage of correct responses given by an examinee; this allowed for convenient calculations by hand and still correlated strongly with more complex parametric signal-detection measures such as *d'* but was not well-suited for recognition memory tasks with an unequal number of target and distractor items such as that of the CVLT-II[18].
- However, the CVLT-II, uses a parametric *d'* formula that yields a contrast score that reflects the difference in standard deviation units between an examinee's hit rate and false positive rate[2,12].
- There has been no known investigation of the degree to which population differences in TRD might vary across applications of nonparametric and parametric methods; such knowledge may inform efforts to interpret and compare CVLT-I and CVLT-II findings regarding recognition memory function in HD and AD.

OBJECTIVE

- **Aim 1**: To perform nonparametric and parametric assessments of TRD using the CVLT-II in a relatively large sample of HD and AD patients and cognitively healthy adults
- **Aim 2**: To determine whether or not hypothesized group differences in TRD vary across applications of nonparametric and parametric formulas

PARTICIPANTS

Table 1. *Gender distribution and mean values (standard deviations) of age and education for HD patients (HD), middle-aged adults (MA), AD patients (AD), and older adults (OA).*

Variable	HD	MA	AD	OA
n	66	68	33	35
% Female	58%	47%	24%	46%
Age (years)	47.94 (9.51)	43.63 (15.56)	76.55 (8.60)	75.80 (8.82)
Education (years)	14.38 (2.35)	15.15 (2.17)	15.00 (2.69)	16.06 (1.86)

- Compared to HD patients, AD patients had a significantly greater percentage of men than women, χ^2 (N = 99) = 9.83, p < .01
- No differences in percentage of men and women between HD patients and MA (p > .01) or AD patients and OA (p > .05)
- AD patients were significantly older than HD patients, t(97) = 14.55, p < .001
- No differences in age between HD patients and MA (p > .05) or AD patients and OA (p > .01)
- No differences in education between HD patients and MA (p > .05), AD patients and OA (p > .05), or HD and AD patients (p > .01)

METHOD

CVLT-II Administration

- Oral presentation of 16 target words (List A) followed by 5 immediate recall trials
- Oral presentation of 16 distractor words (List B) followed by a single immediate recall trial
- Free- and cued-recall of List A items after short and long delays
- *Test of yes/no recognition memory for List A items that includes List A, List B, and novel items*

TRD Formulas and Indices

Nonparametric TRD (%):
[1 – (total false positives + total misses) / 48] x 100

Parametric TRD (d'):
z(hit rate) – *z*(false positive rate)

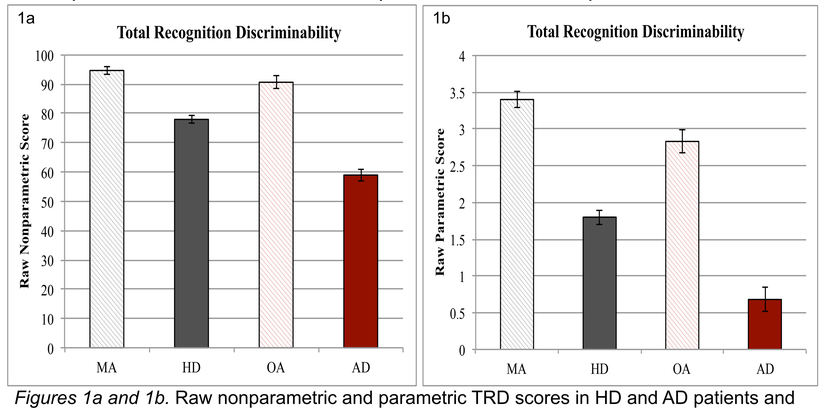
- Scores obtained for analysis:
  - Raw nonparametric TRD scores (Nonp)
  - Raw parametric TRD scores (*d'*)
  - Standardized parametric TRD scores (*z d'*)
- Standardized nonparametric TRD scores not obtained or analyzed, as normative data are unavailable

RESULTS

Table 2. *Inferential and descriptive statistics for all planned group comparisons on TRD indices.*

	Index	HD	MA	*F*	df	*p*	*d*
HD vs MA	Nonp	77.97 (12.42)	94.67 (7.91)	83.62	1, 130	< .001	1.60
	d'	1.80 (0.88)	3.40 (0.73)	127.90	1, 130	< .001	1.98
	z d'	-1.67 (1.25)	0.44 (0.95)	121.74	1, 132	< .001	1.90
	Index	AD	OA	*F*	df	*p*	*d*
AD vs OA	Nonp	58.96 (12.24)	90.65 (6.50)	163.96	1, 64	< .001	3.23
	d'	0.68 (0.61)	2.83 (0.68)	171.57	1, 64	< .001	3.35
	z d'	-2.14 (0.89)	0.34 (0.79)	148.11	1, 66	< .001	2.95
	Index	HD	AD	*F*	df	*p*	*d*
HD vs AD	Nonp	77.97 (12.42)	58.96 (12.24)	15.01	1, 95	< .001	1.54
	d'	1.80 (0.88)	0.68 (0.61)	10.21	1, 95	.002	1.48
	z d'	-1.67 (1.25)	-2.14 (0.89)	3.58	1, 97	.062	0.43

- HD and AD patients performed significantly worse than their respective comparison groups (middle-aged adults and older adults, respectively) on all TRD indices
- Relative to HD patients, AD patients had significantly lower raw parametric and nonparametric TRD scores but comparable standardized parametric TRD scores



Figures 1a and 1b. Raw nonparametric and parametric TRD scores in HD and AD patients and their respective comparison groups.

RESULTS

- Analysis of covariance (ANCOVA) tests examined group differences in raw nonparametric and parametric TRD scores, while controlling for gender and age
- One-way analysis of variance (ANOVA) tests examined group differences in standardized parametric TRD scores
- Three separate ANCOVA/ANOVA tests were conducted for each TRD index to address three planned group comparisons: (1) HD versus MA; (2) AD versus OA; (3) HD versus AD
- Bonferroni-corrected critical alpha level = .017

CONCLUSIONS

- Applying parametric versus nonparametric methods in the assessment of raw TRD scores may potentially result in different estimates of effect sizes associated with certain group comparisons.
- Relative to HD patients, AD patients had comparable standardized parametric TRD scores despite lower raw nonparametric and parametric TRD scores; this is in contrast with CVLT-I evidence for lower standardized nonparametric TRD scores in AD patients relative to HD patients.
- The number (and proportion) of List B distractor items included in the yes/no recognition memory test is greater on the CVLT-II than the CVLT-I.
- HD patients and other individuals with frontal system pathology are known to demonstrate disproportionate source memory deficits, which may manifest in the endorsement of List B distractor items on the CVLT.
- HD patients may therefore exhibit lower TRD scores on the CVLT-II (than on the CVLT-I) given the opportunity to endorse more List B distractor items.
- The noted difference between the CVLT-I and CVLT-II in the number of List B distractor items on the yes/no recognition memory test may account for the observed similarity in (standardized parametric) TRD scores between HD and AD patients in the present study.
- The present findings may have important implications when making comparisons between CVLT-I and CVLT-II findings regarding TRD in HD and AD.

REFERENCES

1. Delis, D. C., et al. (1987). The Psychological Corporation.
2. Delis, D. C., et al. (2000). The Psychological Corporation.
3. Delis, D. C., et al. (1991). *Psychological Assessment: A Journal of Consulting and Clinical Psychology*, *3*, 19–26.
4. Delis, D. C., et al. (2005). *Journal of the International Neuropsychological Society, 11*(6), 708-715.
5. Deweer, B., et al. (1994). *Cortex*, *30*, 113–126.
6. Duarte, A., et al. (2006). *Neuroscience Letters, 406,* 60–65.
7. Fine, E. M., et al. (2008). *Journal of Clinical and Experimental Neuropsychology, 30*(4), 463–470.
8. Johnson, S. A., et al. (1994, February).
9. Kramer, J. H., et al. (1988). *Developmental Neuropsychology, 4,* 1–15.
10. Kramer, J. H., et al. (1989). *Neurology, 3,* 111–120.
11. Lundervold, A. J., et al. (1994). *Scandinavian Journal of Psychology, 35,* 38–47.
12. Macmillan, N. A., & Creelman, D. C. (1991). Cambridge University Press.
13. Massman, P. J., et al. (1993). *Developmental Neuropsychology, 9,* 1–15.
14. Massman, P. J., et al. (1990). *Journal of Clinical and Experimental Psychology, 12*(5), 729–744.
15. Massman, P. J., et al. (1992). *Journal of Clinical and Experimental Neuropsychology*, *14*, 687–706.
16. Mendez M. F., & Ashla-Mendez, M. (1991). *Journal of Clinical and Experimental Neuropsychology, 13,* 923–932.
17. Sherod, M. G., et al. (2009). *Journal of the International Neuropsychological Society, 15*(2), 258–267.
18. Underwood, B. J. (1974). *Journal of Experimental Psychology Monographs, 102,* 917–939.

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