

Identifying Frank Neurocognitive Impairment with CNS Vital Signs in Patients with Untreated Depression

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Abstract

There is considerable interest in the identification of neurocognitive impairment in patients with depression. The purpose of this study is to illustrate a methodology for identifying frank neurocognitive impairment in clinical practice and research. Participants were 100 adult patients with depression who were not on antidepressants. They were carefully matched on age, education, gender, and ethnicity to 100 healthy adult control subjects. All participants completed CNS Vital Signs, a computerized assessment battery that takes approximately 30-40 minutes to administer. Patients with depression performed more poorly than controls on all five domain scores (Cohen's d ranged from d = .37 to .72). When using two or more scores below the 5th percentile as the cutoff for frank neurocognitive impairment, 31.0% of the depressed sample and 5.0% of the control sample scored in this range [$\chi^2(1) = 22.90, p < .001$; Odds Ratio = 8.5, 95% CI = 3.3 – 22.3; Sensitivity = .31, Specificity = .95, Positive Predictive Value = .86, 95% CI = .73 – .94, Negative Predictive Value = .58, 95% CI = .55 – .60]. In this study, patients with depression were 8.5 times more likely to have two or more index scores that were below the 5th percentile.

Introduction

Perceived problems with concentration, memory, problem solving, and thinking skills are a cardinal diagnostic feature of major depressive disorder.

The effects of depression on formal neuropsychological testing can range from striking and extreme to virtually non-existent.

Zakzanis, Leach, and Kaplan (1998) conducted a meta-analysis and reported that reductions in memory, psychomotor speed, and sustained attention were the most prominent neurocognitive features of depression.

Purpose: To illustrate a clinical methodology for identifying frank neurocognitive deficits in adults with depression using a computerized neurocognitive assessment battery.

Participants

100 unmedicated adults with depression (i.e., Major Depressive Disorder or Depressive Disorder NOS) and 100 precisely-matched healthy control subjects (see Table 1 for demographics).

Measure

CNS Vital Signs is comprised of seven common neuropsychological measures, including verbal and visual memory, finger tapping, symbol digit coding, the Stroop test, a shifting attention test, and a continuous performance test.

The battery generates 15 primary scores, which are used to calculate 5 domain scores (Memory, Psychomotor Speed, Reaction Time, Cognitive Flexibility, and Complex Attention) and a summary score (Neurocognition Index).

Results

The two groups were compared on the five domain scores using multivariate analysis of variance (MANOVA) followed by univariate ANOVAs.

The multivariate effect was significant [Wilks' Lambda = .84; $F(5, 194) = 7.68, p < .001$, partial eta squared = .17, observed power = .99].

The follow-up univariate ANOVAs revealed significantly worse neuropsychological test scores for those in the depression group on all five domain scores (see Table 2 and Figure 1).

Of the patients with depression, 47.0% obtained two or more scores below 1 SD, compared to 16.0% of the control group [$\chi^2(1) = 22.27, p < .001$; Odds Ratio = 4.7, 95% CI = 2.4 – 9.0].

When using two or more scores below the 5th percentile as the cutoff, 31.0% of the depressed sample and 5.0% of the control sample scored in this range [$\chi^2(1) = 22.90, p < .001$; Odds Ratio = 8.5, 95% CI = 3.3 – 22.3; Sensitivity = .31, Specificity = .95, Positive Predictive Value = .86, 95% CI = .73 – .94, Negative Predictive Value = .58, 95% CI = .55 – .60].

Discussion

The results of this study are largely consistent with the neuropsychological theories and empirical studies on the neurocognitive effects of depression.

Depressed patients performed more poorly on computerized tests of complex attention, processing speed, reaction time, memory, and cognitive flexibility.

These patients with untreated depression obtained significantly more impaired domain scores across the entire battery, as well. A subset of unmedicated patients with depression have frank neurocognitive impairment. In this study, patients with depression were 8.5 times more likely to have two or more index scores that were at or below the 5th percentile (95% CI = 3.3 – 22.3; PPP = .86, 95% CI = .73 – .94).

This information might be helpful for better understanding the nature of some patients' illness, for making recommendations regarding coping with and compensating for their cognitive difficulties, and for encouraging treatment adherence.

Table 1. Demographic characteristics of the samples age, education, sex, and ethnicity.

	Depressed Sample (N = 100)	Matched Controls (N = 100)	t test (p value)
Age	39.1 (12.5)	39.2 (11.8)	0.08 (0.94)
Age Range	18-69	18-68	---
Education	14.8 (2.4)	15.0 (2.3)	0.54 (0.59)
Education Range	6-20	7-20	---
Male: Female	29:71	29:71	---
Caucasian: African American: Hispanic	89:9:2	89:9:2	---

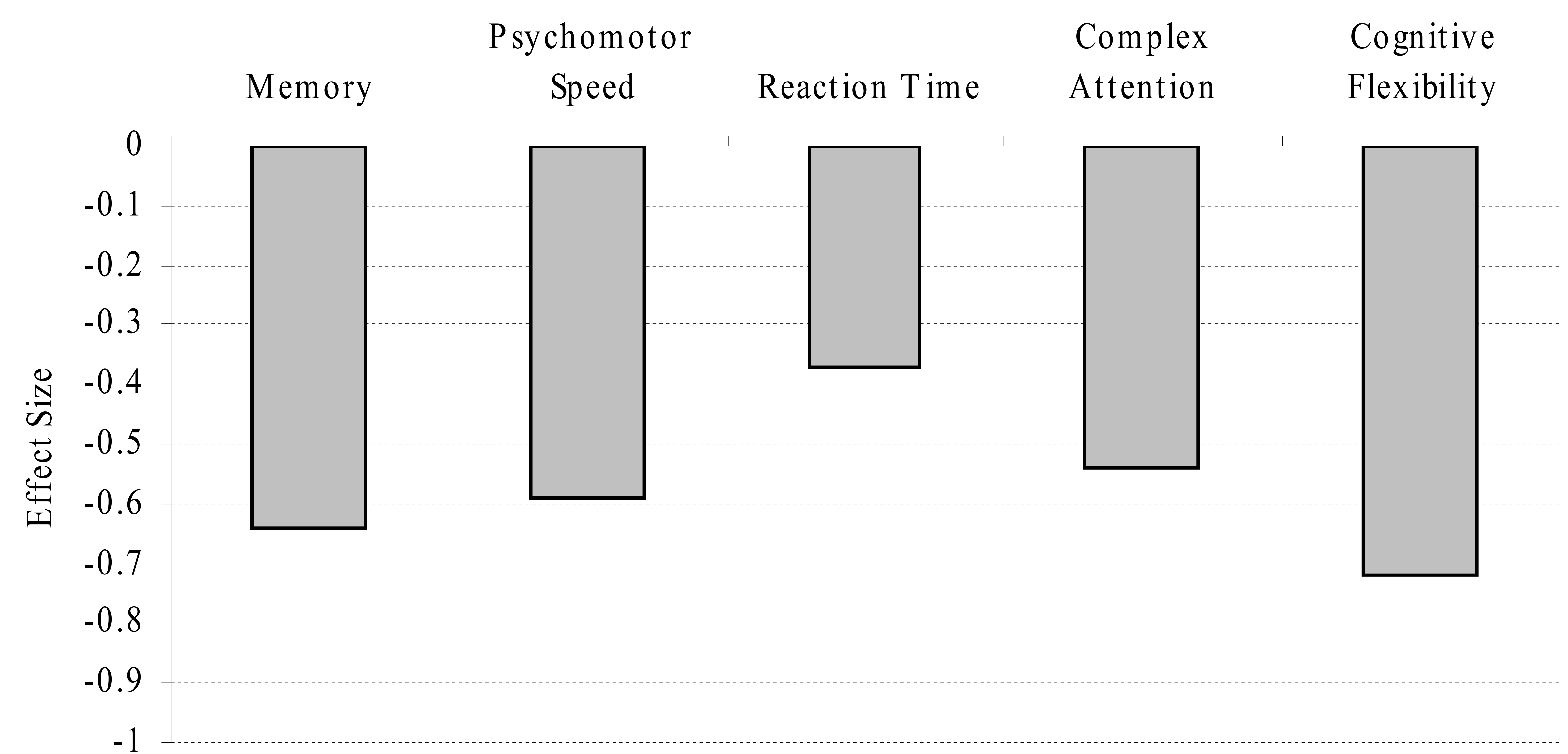
Note: Degrees of freedom for t test was (198).

Table 2. CNS Vital Signs test performance in depressed and matched control samples.

	Depressed Sample	Matched Controls	F test (p value)	Cohen's Effect Sizes (d)
Sample Sizes (n)	100	100	-	-
Memory Index (SD)	88.8 (22.8)	100.5 (14.0)	18.97 (<.001)	0.64
Processing Speed Index (SD)	89.7 (23.2)	101.5 (16.8)	17.08 (<.001)	0.59
Reaction Time Index (SD)	92.6 (28.1)	101.0 (17.4)	6.60 (.011)	0.37
Cognitive Flexibility Index (SD)	88.2 (28.9)	100.5 (16.8)	13.52 (<.001)	0.54
Complex Attention Index (SD)	84.3 (33.1)	102.2 (16.8)	23.19 (<.001)	0.72

Note: Degrees of freedom for ANOVAs was (1, 198). Domain scores have a mean of 100 and SD of 15 in healthy adults.

Figure 1. Effect sizes on the CNS Vital Signs domain scores in patients with untreated depression.



Note: Bars represent effect sizes (Cohen's d) for the five domain scores from the CNS Vital Signs battery. Downward bars were used to illustrate lower performance in depressed patients (n = 100) compared to individually and precisely matched control participants (n = 100). By convention, Cohen's effect sizes are interpreted as follows: -.2 = small, -.5 = medium, and -.8 = large.

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