

Recovery of Cognitive Function in a Substance Abuse Population

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BACKGROUND

Impairments to cognition following substance abuse may not be entirely repaired by sobriety¹⁻².

Working memory, executive function, and attention are the most often recognized cognitive impairments in substance use disorders³⁻⁴. In addition, opioid use disorder has been shown to impair memory⁵⁻⁶.

Impairments in these areas of cognitive functioning not only impact the individuals' daily functioning, but may also present additional obstacles in these individuals' pursuit of substance abuse treatment. Studies have shown that cognitive impairment is associated with worse treatment outcomes including higher rates of relapse^{4,7}.

Objective: Pilot study testing the natural rate of cognitive recovery in early substance abuse treatment.

Primary Outcome: Compare Baseline and Endpoint scores on the NIH Toolbox Cognitive Measures to determine if there are significant changes in cognition during the first 4 weeks of recovery from substance use.

METHODS

Participants

Participants were 28 adults newly admitted to a residential substance abuse treatment facility. All participants had completed detoxification. The majority of participants were being treated for polysubstance abuse, with 15 participants having primary opioid abuse.

Demographics:

- 89% male
- 89% right-handed
- 68% Caucasian, 32% multiracial; 86% non-Hispanic
- Mean age of 35.25 years (SD 8.58)
- Mean education of 17.5 years (SD 4.73)

Procedure

The participants were evaluated at the beginning of their treatment and again after 4 weeks of treatment. Participants were evaluated on attention, executive functioning, episodic and working memory, language, and processing speed using the NIH Toolbox Cognition Battery. The assessment is administered via iPad and takes approximately 45 minutes to complete.

Fluid Cognition Measures:

- Flanker Inhibitory Control and Attention Test
- Picture Sequence Memory Test (Episodic Memory)
- List Sorting Working Memory Test
- Dimensional Change Card Sort Test (Executive Functioning)
- Pattern Comparison Processing Speed Test
- Rey Auditory Verbal Learning Test (Immediate Recall)
- Oral Symbol Digit Test (Processing Speed)

Crystallized Cognition Measures:

- Picture Vocabulary Test
- Oral Reading Recognition Test

Table 1. NIH Toolbox Subtest Scores: Treatment Completers (n=17) vs. Non-Completers (n=11)

Subtest	Mean-C	SD	Mean-NC	SD	Sig.
Picture Vocabulary	49.18	13.483	47.44	5.548	0.019*
Fluid Cognition (composite)	44.71	12.097	45.44	14.284	0.418
Crystallized Cognition (composite)	52.35	13.276	48.44	4.096	0.011*
Cognitive Total (composite)	48.41	12.525	46.11	8.462	0.424

No significant mean group difference at baseline in the following subtests (p-value): Oral Reading Recognition (0.13), List Sorting Working Memory (0.15), Pattern Comparison (0.27), Picture Sequence Memory (0.24), Flanker Inhibitory Control (0.32), Dimensional Change Card Sort (0.92), Auditory Verbal Learning (0.08), Oral Symbol Digit (0.76).

Table 3. NIH Toolbox Subtest Mean T-Scores, Change Over Time

Subtest	Time1	T1 SD	Time2	T2 SD	Change (T2-T1)	Change SD	Change Sig.
List Sorting Working Mem.	44.04	8.039	50.76	8.066	5.06	9.556	0.045*
Pattern Comparison	41.96	19.091	57.24	13.818	16.47	16.923	0.002**
Flanker Inhibitory Control	43	14.103	48.82	13.201	8.82	9.235	0.002**
Dim. Change Card Sort	51.75	13.321	60.41	13.811	6.47	11.063	0.013*
Oral Symbol Digit	72.93	17.67	84.12	19.374	10.06	12.774	0.001**

No significant mean change from Time 1 to Time 2 in the following subtests (p-value): Picture Vocabulary (0.46), Oral Reading Recognition (0.06), Picture Sequence Mem. (0.86), Auditory Verbal Learning (0.14).

Table 2. Composite Mean T-Scores, Change Over Time

Composite	Time1 Score	T1 SD	Time2 Score	T2 SD	Change Score	Change SD	Change Sig. (p-value)
Fluid Cognition	44.57	12.55	56.12	12.68	11.41	9.85	0.001**
Crystallized Cognition	51.04	10.63	55.94	11.82	3.59	8.06	0.108
Cognitive Total	47.39	10.87	57.18	11.63	8.76	6.91	0.001**

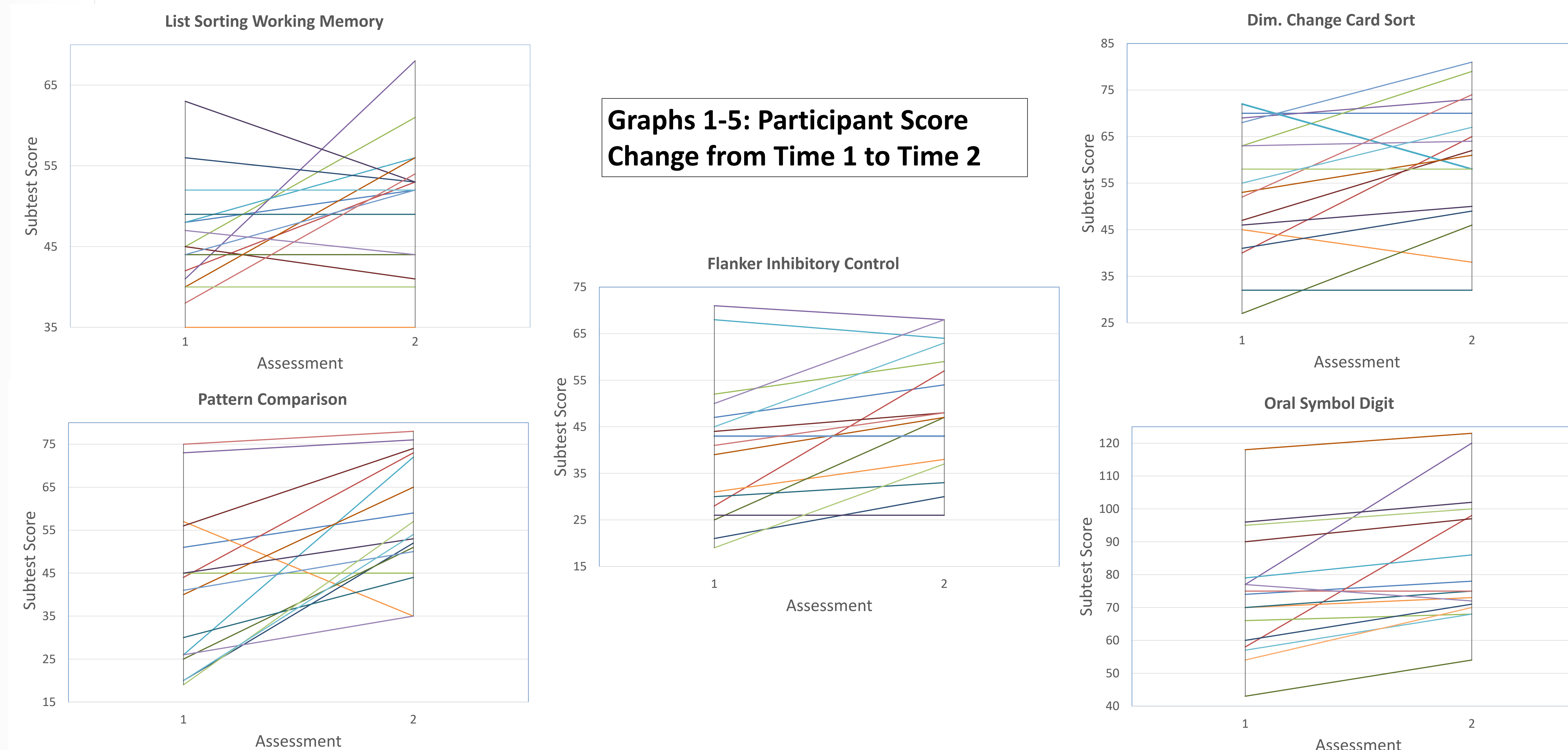
All Toolbox scores are fully corrected t-scores where available. (Oral Symbol Digit is raw scores)
Key
 * = p < 0.05 ** = p < 0.001

RESULTS SUMMARY

- Primary cognitive weaknesses at baseline were in processing speed (Pattern Comparison mean t-score=41.96), attention and executive function (Flanker mean t-score=43.0) and working memory (List Sorting mean t-score=44.04).
- Cognitive recovery during the normal course of early inpatient treatment was significant in the areas of processing speed, attention and executive functioning and yielded significant improvement in the Cognitive Function Composite Score (p < .01).

CONCLUSIONS

- Substance abuse is known to cause injury to the brain that may not be fully repaired by sobriety. Consistent with previous research, this pilot study found that patients commonly enter inpatient treatment with inefficiencies in fluid cognition skills.
- Over the course of 1-month of inpatient treatment, this sample of patients experienced significant improvement across multiple domains, with significant improvements in composite Fluid and Total Cognition scores.
- This pilot study informs a series of planned studies on cognitive recovery. Further study on the pattern of cognitive changes during substance abuse treatment may be used to help better match intervention strategy to cognitive level and possibly develop cognitive rehabilitation protocols to increase treatment engagement and extend abstinence via improvement in cognitive capacity.



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