HIV and Addictions Research Program

Impact of Web-Based Cognitive Training on Working Memory in Cocaine Users with HIV

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Background

- Cocaine use is disproportionately prevalent among persons with HIV.
- Cocaine exacerbates HIV-associated neurocognitive impairments, specifically working memory, that contribute to impulsive decision making.
- HIV-infected cocaine users are also more likely to engage in risky behaviors associated with poor HIV clinical outcomes and forward transmission of HIV to others.

Specific Aims

- Test the efficacy of a web-based cognitive training intervention to improve working memory and reduce impulsivity in HIV-infected cocaine users

Methods

- Recruitment: advertisements in the community; fliers in infectious diseases clinics; peer referral
- Eligibility criteria: confirmed HIV diagnosis, age ≥ 18 years, ≥ 1 year of regular cocaine use, cocaine use disorder
- Exclusions: neurological disorders, <9 years education
- Intervention: 48 cognitive training sessions, over 10 weeks
  - Web-based Lumosity program (www.lumosity.com)
  - 20-30 minute sessions of 8 games
- Randomized controlled trial with two arms:
  - Active (ACT): games targeted working memory
  - Control (CON): games targeted other domains
- Assessments: completed at baseline and post-intervention
  - Substance use, including a urine drug screen and clinical interviews
  - Comprehensive neuropsychological testing, including 3 working memory tests
  - A delay discounting task to assess impulsivity
- In total, 81 individuals enrolled and completed an in-depth screening. Of these, 67 (83%) were eligible. Of the 67 eligible participants, 7 declined, 2 were lost, and 58 completed the baseline assessment.

Analytic Plan

- 2 (Condition) by 2 (Time) general linear model (GLM) on working memory (domain deficit score on the 3-test battery) and delay discounting (natural log k-value).
- Models controlled for age, education, and number of games improved (a proxy of intervention engagement).

Web-based cognitive training is a promising intervention for **improving working memory** in cocaine users with HIV.

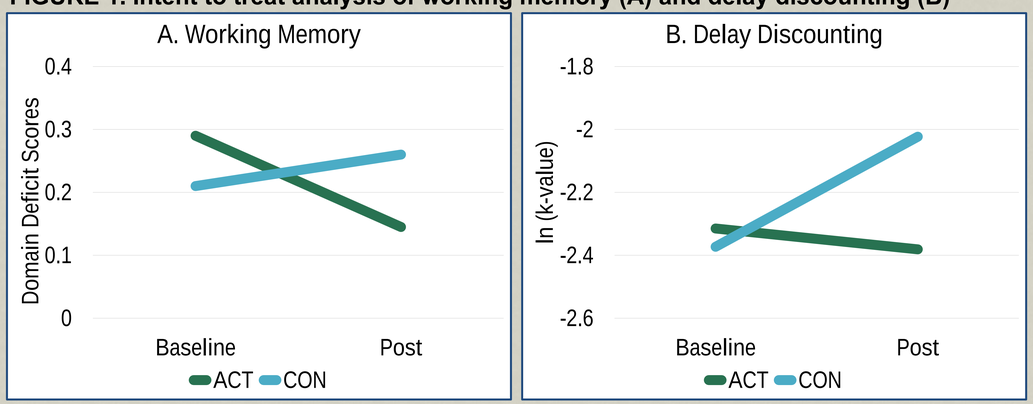
Results

- The sample was 48.6 years old on average and mostly African American (88%).
- The majority reported their sex as male (72%), and 98% of participants identified as cisgender. One participant identified as a transgender woman.
- There were no group differences on participant characteristics (Table 1), indicating that randomization was successful in ensuring equivalent groups.

Table 1. Participant Characteristics

	ACT *N* = 29	CON *N* = 29	Statistic
Male sex	83%	62%	$\chi^2(1)=3.11$
Age	49.0 (10.1)	48.3 (8.3)	$t(56)=0.29$
African-American	93%	83%	Fisher's test
Education in years	12.1 (2.7)	11.9 (2.1)	$t(56)=0.33$
Years of regular cocaine use	19.4 (11.3)	16.1 (10.0)	$t(56)=1.18$
Days of cocaine use in past 90 days	22.4 (26.8)	21.2 (21.3)	$t(56)=0.2$
Past year cocaine use disorder	86%	79%	Fisher's test
Years since HIV diagnosis	15.8 (31.1)	15.3 (8.6)	$t(48)=0.21$

FIGURE 1. Intent to treat analysis of working memory (A) and delay discounting (B)



Results

- Participants completed 37.3 of the 48 possible sessions on average, with no difference by arm.
- 56 participants (97%) completed the post-intervention follow-up. Of the two participants who were lost to follow-up, one moved out of state and the other went to a long-term residential treatment program.
- In the intent-to-treat sample, there was a significant group-by-time interaction for working memory with a medium effect size [$F(1, 51) = 4.470$, $p = .039$, $\eta_p^2 = 0.081$], such that ACT had greater improvements relative to CON.
- For delay discounting, there was a similar pattern, again with a medium effect, but the interaction effect was not significant [$F(1, 48) = 3.546$, $p = .066$, $\eta_p^2 = 0.069$].
- There were no significant group-by-time effects for other cognitive domains, with all $\eta_p^2 < .005$, suggesting that the intervention effect was specific to working memory.
- Overall, participants reported being satisfied with the sessions (M=4.09 , on 5 point scale) and rated the sessions as helpful (M=4.09), but those in ACT perceived greater improvement on the games over time [M=4.39 (0.69) vs. 3.89 (0.92); $t(54)= 2.31$, $p= .025$].

Conclusions

- Our findings support the potential efficacy of cognitive training to improve working memory in HIV-infected cocaine users. The results showed a trend for reduced impulsivity.
- With generally high ratings from participants for both helpfulness and satisfaction, our results also support the feasibility and acceptability of this intervention. However, a subsample of participants (n=6) did not complete any sessions after their baseline appointment.
- A larger trial with a longer duration of training targeting more domains is needed to test the durability of effects and improvement in daily living.

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