Research Brief

Individualized-Targeted Computerized Cognitive Training to Treat HIV-Associated Neurocognitive Disorder: An Interim Descriptive Analysis

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Key words: *brain fitness, cognitive reserve, cognitive training, HIV-associated neurocognitive disorder, neuroplasticity, speed of processing*

Nearly 50% of adults with HIV experience various degrees of HIV-associated neurocognitive disorder (HAND; Heaton et al., 2010). HAND is diagnosed using the Frascati criteria, a consensus-derived neurocognitive algorithm used in neuroAIDS research. When an individual performs more than 1 standard deviation below his/her demographically based norm (i.e., age/education adjusted) in two or more cognitive domains, then the criteria for HAND have been met (Blackstone et al., 2012). Aging often exacerbates such cognitive problems. In fact, studies clearly show that older adults with HIV perform worse on neurocognitive measures than those without HIV and younger adults with HIV (e.g., Goodkin et al., 2017). With nearly 70% of the people living with HIV in the United States projected to be 50 years of age or older by 2020, this represents a unique challenge for nurses and health care professionals (U.S. Senate Special Committee on Aging, 2013).

Despite the need for cognitive interventions to address HAND, few approaches are available. Pharmacologic interventions such as lithium and methylphenidate have been attempted with limited, short-lived therapeutic effects, and with potential adverse side effects. Moreover, the addition of yet another prescribed medication to a clinical population facing multiple comorbidities and vulnerable to polypharmacy is not encouraged (Vance, Fazeli, Moneyham, Keltner, & Raper, 2013). Thus, behavioral interventions that promote positive neuroplasticity to protect and improve cognitive reserve are encouraged.

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JOURNAL OF THE ASSOCIATION OF NURSES IN AIDS CARE, Vol. ■, No. ■, ■/■ 2018, 1-8
https://doi.org/10.1016/j.jana.2018.04.005

Computerized cognitive training programs have been shown as a safe and effective way to improve cognitive function (Lampit, Hallock, & Valenzuela, 2014). For example, in a two-group pre/post study of 46 middle-aged and older adults (40 years and older) with HIV, Vance, Fazeli, Ross, Wadley, and Ball (2012) randomized participants to either a no-contact control group or a speed-of-processing training group. Those in the speed-of-processing training group engaged in 10 hours of specially designed computer games that required participants to quickly process complex visual information. The games were adaptive such that they provided feedback on performance and also varied the speed and difficulty of the tasks so participants were always challenged near their upper threshold abilities. Compared to the control group, those who received this cognitive training improved significantly ($p = .04$) on a visual speed-of-processing measure, which translated to significant ($p = .03$) performance improvement on the Timed Instrumental Activities of Daily Living test (Owsley, Sloane, McGwin, & Ball, 2002).

Despite the limited use of cognitive training in HIV, cognitive training in HIV-uninfected community-dwelling older adults has been well researched. In a meta-analysis of 52 cognitive training studies of older adults without HIV, Lampit and colleagues (2014) found that, across cognitive domains, the average cognitive improvement following cognitive training was 0.22 standard deviations. Pooling effect sizes across these studies, significant therapeutic improvement in various domains differed widely: speed of processing ($g = 0.31$), visuospatial skills ($g = 0.30$), nonverbal memory ($g = 0.24$), working memory ($g = 0.22$), and verbal memory ($g = 0.08$). Despite some studies showing significant improvement in attention and executive functioning, pooled effect sizes were not significant for these domains.

Targeted Cognitive Training Approach

Because many cognitive training programs are known to improve performance in certain cognitive domains in as much as 1 to 1.5 standard deviations above one's demographically based (age/education) norms (Lampit et al., 2014), it is plausible that HAND diagnosis mediation may be possible. In many cases, the person may be only a fraction of a standard deviation away from being within the "normal" cognitive range for his/her age/education. Thus, targeting those cognitive domains for cognitive training may result in small to moderate improvement, perhaps enough to no longer meet the criteria of HAND, thus reversing the research diagnosis.

Purpose

Building on this information, an ongoing R21 randomized clinical trial (the Training on Purpose [TOPS] Study; proposed $N = 146$) is examining the effectiveness of this targeted cognitive training approach to reduce the prevalence of HAND in middle-aged and older adults (40 years of age and older) with HAND (Vance et al., 2018). Employing a two-group pre/post design in our case comparison study, six adults with HAND were randomized to: (a) the cognitive training group ($n = 3$), or (b) the no-contact control group ($n = 3$).

Methods

Overview

From the ongoing parent study, three participants from each of the treatment arms were randomly selected for description and comparison. Pre and post score comparisons are presented to show changes over time. The University of Alabama at Birmingham Institutional Review Board approved the parent study.

Participants

As part of the ongoing parent study, participants were recruited from flyers posted at clinics; eligibility was determined through a telephone screen. Eligible participants had to have been: (a) diagnosed with HIV, (b) 40 years of age or older, (c) free of any severe neuromedical condition (e.g., bipolar disorder), and (d) able to participate in written and oral activities in English. Participants were not screened for vitamin deficiencies that could contribute to cognitive impairment. Eligible participants were consented