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Feasibility of a Home-based Speed of Processing Training Program in Middle-aged and Older Adults with HIV

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Abstract

There has been much optimism over the positive impact of cART on life expectancy for people with HIV; however, those aging with HIV fear potential day-to-day challenges associated with the development of cognitive deficits. The presence of cognitive deficits has generated major safety concerns as it has been shown to impact driving, mobility, and employment. Given the efficacy of a computerized speed of processing training program administered in the laboratory to older adults and adults with HIV, this study was designed to determine the feasibility of a home-based speed of processing training program in improving cognitive function in middle-aged and older adults with HIV. In this within-subjects pre-post experimental design, twenty middle-aged and older adults (i.e., age 40+) with HIV were administered a brief neuropsychological assessment to gauge their baseline cognitive function before participating in a 10-hour home-based computerized cognitive remediation training program. In addition to self-reported cognitive gains, a six-week posttest indicated significant improvements on the Useful Field of View (UFOV®), a measure of speed of processing and possible transfer to the Timed Instrumental Activities of Daily Living test, a measure of everyday functioning. These findings show that speed of processing training can successfully improve cognitive function in this vulnerable population even when administered in remote settings such as the privacy of one's home.

Keywords

HIV/AIDS; Aging; Cognition; Speed of Processing; Cognitive Remediation

The availability and efficacy of combination antiretroviral therapy (cART) has increased life expectancy for people with HIV (Manfredi, 2004; Smith, 2006). In fact, 70% of those living with HIV in the United States will be age 50 and older by 2017 (U.S. Senate Special

Committee on Aging, 2013). Unfortunately, concerns mount that those aging with HIV will experience premature or accelerated cognitive aging in memory, executive functioning, and speed of processing. Speed of processing, the ability to quickly process sensory and mental information, has been shown to be compromised in older adults with HIV (e.g., Ciccarelli et al., 2012). The synergistic or additive effects of aging and HIV may cause speed of processing deficits to be even more profound, thus interfering with everyday functioning (Vance, Fazeli, Ross, Wadley, & Ball, 2012). The negative effects of speed of processing deficits on daily activities such as driving are a major safety concern. Few studies focus on promoting successful aging and helping older adults with HIV adapt to such speed of processing deficits (Vance, Fazeli, Moneyham, Keltner, & Raper, 2013).

In prior studies, speed of processing training has been successful in improving cognitive function in adults with and without HIV (Ball et al., 2002; Vance et al., 2007; Vance et al., 2012). A recent study of 46 participants with and without HIV revealed that those randomized to the speed of processing training group experienced improvements in speed of processing and everyday functioning (Vance, Fazeli, Ross, Wadley, & Ball, 2012). Speed of processing training involves computerized mental exercises used to improve an individual's ability to identify, locate, and discriminate objects after viewing them for very short periods of time (Ball, Edwards, & Ross, 2007). Some of these tasks are performed simultaneously while the duration of exposure to visual stimuli decreases, thus making the task more complex and tailored to each individual's level of functioning (Ball et al.). Such training is designed on the principles of positive and negative neuroplasticity. Positive neuroplasticity involves the development of new neuronal connections and strengthening of existing connections in response to a novel stimulating activity (i.e., learning a new task); thus, these neurological changes may increase cognitive reserve and facilitate learning (Mahncke, Bronstone, & Merzenich, 2006; Vance & Wright, 2009). In contrast, exposure to elements that promote negative neuroplasticity (e.g., stress, substance abuse, insomnia) inhibits formation of new neuronal connections and may decrease cognitive reserve, which in turn may make the brain more susceptible to cognitive deficits (Mahncke et al., 2006; Vance, Roberson, McGuiness, & Fazeli, 2010; Vance & Wright, 2009).

In many speed of processing studies, scores on the Useful Field of View (UFOV®) test, a neuropsychological measure of visual attention and speed of processing, have been shown to correlate with performance on complex everyday tasks such as instrumental activities of daily living (IADLs) like driving. Ball and colleagues (2007) found this association when they examined the impact of speed of processing training on cognitive ability in community-dwelling older adults with and without speed of processing deficits. While both groups performed the speed of processing tasks faster after receiving similar speed of processing training, older adults with baseline speed of processing deficits (i.e., high scores on the UFOV® test) showed greater improvement in all four subsets of the speed of processing task (Ball et al.). Findings in this study suggest that while speed of processing training enhances cognitive ability in older unimpaired adults, the training can be more beneficial for older adults who have already developed cognitive deficits that may negatively affect everyday tasks such as taking medication, handling finances, and driving (Ball et al.).

Other studies suggest cognitive gains from speed of processing training may translate to improvements in everyday activities, particularly driving performance. In a recent study of 26 older adults with HIV, Vance and colleagues (2014) used driving simulations and UFOV[®] tests to examine the relationships between cognitive function, driving outcomes, and everyday task performance. These researchers found that participants who performed better on the UFOV[®] test (i.e., lower scores) had faster reaction times (i.e., pressed the brake more quickly when a large stop sign was displayed on the monitor) and faster divided attention reaction times (i.e., pressed button to the left or right of the steering wheel when they saw a flashing red arrow on the corresponding monitor). Compared to participants who performed well on the UFOV[®] test, those with poorer UFOV[®] performance also had poorer executive function (i.e., lower Trails B scores) in addition to slower reaction times, more driving collisions, and more accidents involving pedestrians in the driving simulator. In general, increasing age reflected slower reaction times and poorer UFOV[®] performance (Vance et al.). Likewise, these significant findings were consistent with findings in prior studies that examined driving performance in adults with HIV (Marcotte et al., 2004, 2006); they also highlight the value of the UFOV[®] test in predicting driving risk and decision-making abilities in aging adults with HIV.

Considering the benefits of speed of processing training, there is still a need to create widespread availability of the speed of processing training program. While studies in non-HIV samples have shown that speed of processing training self-administered at home is just as effective as in person training in the laboratory (Wolinsky et al., 2013), no studies have examined the comparability of these training venues in adults with HIV. Thus, this pilot study was designed to evaluate the cognitive and everyday effects of a computerized home-based speed of processing training in middle-aged and older adults with HIV. The study was developed with two aims: 1) determine if home-based speed of processing training improved cognitive and everyday function in middle-aged and older adults; and, 2) determine the feasibility of a cognitive home-based training by evaluating participant feedback, participant outcomes, and attrition.

Methods

Participants

This single group, within-subjects pre-post experimental study targeted middle-aged and older adults with HIV (i.e., aged 40+). Participants were recruited by word of mouth, flyers, and brochures through a local university HIV clinic. Potential participants were instructed to call the study coordinator who then screened them to determine if they met study criteria. Participants were excluded if they were HIV-negative ($n = 1$), homeless ($n = 0$), mentally impaired ($n = 0$), deaf or blind ($n = 0$), experienced brain trauma with loss of consciousness greater than thirty minutes ($n = 3$), had other significant neuromedical diagnosis (e.g., schizophrenia, bipolar disorder; $n = 3$), were younger than 40 years of age ($n = 3$), or had no computer or internet access at their home ($n = 8$). A small number of the remaining potential participants could not be reached due to non-working telephone numbers or inability to schedule appointments.

Intervention

Speed of processing training involves playing games using a computer program; these games are mental exercises specifically designed to increase the rate and accuracy in which participants visually perceive certain stimuli within their useful field of view. Although prior studies have used various versions of the speed of processing training (Ball et al., 2002; Vance et al., 2007), the latest computerized version, RoadTour, was used in this study. This study was supported through an internal grant provided by the UAB Center for Aging and POSIT Science provided free use of the software which was supplied in individual CD Roms that were given to participants. Similar to previous speed of processing training studies, participants were asked to identify the central stimuli (i.e., a vehicle) presented in the center of the monitor and also identify the vehicle presented in one of eight peripheral fields as quickly as possible. If participants performed the tasks correctly, the difficulty level increased with each trial requiring participants to complete concurrent tasks at faster speeds as well as locate objects among distractors. However, if participants performed the last task incorrectly, the task automatically decreased in speed and/or the participants received a simpler subsequent task; this is referred to as a double-stair case technique. This variation allowed participants to perform speed of processing tasks at their threshold level; thus, optimizing positive neuroplasticity. Participants were given the software after the baseline visit with some written instructions of how to load it onto their home computer. If they experienced any difficulty, they called study staff to walk them through the procedure. Participants kept a log of how many times they played with this program.

Instruments

Demographic Questionnaire—An experimenter-generated measure was used to gather data on background characteristics such as gender (*0 = women; 1 = men*), ethnicity (*African American = 1; Caucasian = 0*), age (*years*), and education (*years of schooling*).

Health Information—Participants authorized a request to access their electronic medical records with the university clinic during the consent process in order to provide detailed information about their HIV history including their use of cART, current CD4+ lymphocyte count, and plasma viral load.

Cognitive Measures

Useful Field of View (UFOV®) Test—The computerized version of this instrument was used to measure visual attention and speed of processing. Similar to previous studies, this test consisted of four subtests beginning with easy tasks that become more complex. After an object, in this case a car or truck, was displayed in the center of the computer screen at various speeds between 17 and 500 milliseconds, participants were asked to identify the object (car/truck) in subtest 1, which is a measure of simple speed of processing. In subtest 2, a measure of divided attention, participants were similarly presented an object in the center of the computer screen in addition to a car in one of eight peripheral visual fields; this part required participants to identify the central object while simultaneously selecting the peripheral location of the car. The tasks in subtest 3 were similar to those in subtest 2; however, participants were presented with distractors in the periphery, which made it more

difficult to detect the location of the stimuli. The tasks in subtest 4 differed from the previous subtests in that participants were asked to determine if two objects displayed in the center of the computer screen were the same or different (i.e., two cars, two trucks, or one car and one truck) while also locating the car hidden among distractors in the periphery, as in subtests 2 and 3. Subtests 3 and 4 are considered measures of selective attention given the inclusion of distractors. The computer automatically provided a simpler task when participants answered test items incorrectly; whereas, participants were provided a more complex task when they answered test items correctly. The total time in milliseconds of all four subsets was used to calculate visual speed of processing; fewer milliseconds indicated faster visual speed of processing (Ball, Edwards, & Ross, 2007). Test-retest reliability is quite high and ranges from 0.74 to 0.81 (Edwards, Vance, Wadley, Cissell, Roenker, & Ball, 2005).

Wisconsin Card Sorting Test—This test is a computer-based measure of executive function and set shifting in which participants matched cards according to color, shape, or number. After participants accurately completed ten consecutive matches, the category automatically changed and the participants were asked to match the cards according to the new category (e.g., color, shape). The test ended after the participants completed all six categories or 128 trials. Higher percentages of correct responses reflected a higher level of executive function; whereas lower percentages indicated deficits in the executive function domain including working memory, attention, task flexibility, and problem solving (Hatta, Nishihira, & Higashiura, 2013; Kongs, Thompson, Iverson, & Heaton, 2000). Test-retest reliability after 1 year is 0.56 (Lineweaver, Bond, Thomas, & Salmon (1999).

Finger Tapping Test—This common psychomotor test was used to detect alterations in rhythmic patterns due to aging and cognitive disorders (Arias, Robles-García, Espinosa, Corral, & Cudeiro, 2012; Reitan & Wolfson, 2008). Participants were asked to tap their index finger quickly using a digital tapping device for ten seconds. The device displayed the number of taps completed in ten seconds for a single trial. Third, participants were asked to complete a total of ten trials, five trials for each hand. The average number of taps performed in five trials for both hands was used to evaluate psychomotor performance; higher averages indicated better psychomotor performance. According to Lezak (1995), reliability of this test is quite high ($r = 0.94$).

Timed IADL Test—This performance-based test measures accuracy and speed of performing IADLs (e.g., counting money, shopping), tasks that mirror everyday function (Owsley, Sloane, McGwin, & Ball, 2002). Participants were asked to complete five timed tasks which included locating a number in a phonebook, counting money, searching a shelf for specific food items, identifying ingredients on can foods, and reading directions on medicine bottles. Participants were given three minutes to complete the phonebook search and two minutes for each of the other four tasks. Accuracy was determined by the participants' ability to complete the tasks with no errors, minor errors, or major errors. Incorrect task performance resulted in an increase in the time penalty required to complete the task. Major errors resulted in the maximum time penalty. Minor errors resulted in a time penalty of 1 standard deviation added to their time; this standard deviation was derived from

those participants' time that completed the task correctly. Each of the five tasks was then summed to derive a composite score. A composite score of the tasks completion time and accuracy represented the level of IADL functioning; lower scores indicated better IADL functioning. Test-retest reliability of TIADL is 0.64 (Owsley et al.).

Exit Survey—Participants were administered an exit survey consisting of both open-ended and five Likert-type questions to assess feasibility of the home-based speed of processing training. Participants were encouraged to respond to open-ended questions regarding what they liked/disliked about the training, what improvements they felt were needed, and whether they would recommend the training to others. The five Likert-type questions focused on the participants' experience and how they felt the speed of processing training impacted their cognitive function. Responses varied on a scale of 1 to 5 (*1 = not at all, 5 = extremely*).

Procedure

Eligible participants came to the research center for baseline/pretest neuropsychological testing that lasted approximately two hours and included several cognitive and everyday functioning measures with several psychosocial and medical measures. At this visit, participants signed a consent form approved by the University of Alabama at Birmingham Institutional Review Board. At the end of the pretest visit, participants received the home-based speed of processing training protocol with computerized software. The participants were advised to use it for two hours per week for five weeks on their personal computers in their own home with the goal of receiving 10 hours of training; participants were given a log to track the amount of time they engaged in the training. Approximately four to six weeks after training was completed, participants were invited back to the center for the 45 minute posttest which included: The UFOV[®], Wisconsin Card Sorting, Finger Tapping, and Timed IADL measures. To achieve the second goal of the study, participants were given a survey at the end of the posttest to solicit their feedback on the speed of processing training protocol. Participants were compensated \$50 for each of their baseline/pretest and posttest visits; they were also compensated \$10 for each hour they engaged in the speed of processing training protocol.

Data Analysis

Data were examined using SPSS 14. The means and standard deviations of the variables are listed in Table 1 (e.g., age, education). Using an intent-to-treat approach, *t*-tests were used to examine treatment effects from pretest to posttest. This means 20 participants were enrolled at baseline, 15 participants returned for the posttest assessment; out of that 15, only 13 engaged in the training. Assumptions of normality, homogeneity of variance, and linearity were satisfied. Alpha was set at $p < .05$. Incidents of missing data were rare (one for Finger Tapping Test at baseline and one for posttest, one pretest for Wisconsin Card Sorting Test at posttest); because of these rare events, list-wise deletion was used in the following analyses rather than imputing the data.

Results

Descriptive Statistics

As seen in Table 1, of the 20 initial adults with HIV enrolled at baseline, their average age was 50.22 ($SD = 6.57$; 40.19 – 60.99) years. Seventy-five percent of the participants had an education level beyond high school. Most were men (75%) and African American (70%). Participants were diagnosed with HIV on average 15.57 ($SD = 6.09$; 2.45 – 6.09) years. The sample was comprised of mostly asymptomatic adults with HIV as evident by an average current CD4+ lymphocyte count of 483.17 ($SD = 262.40$; 182 – 1,300) cells/mm³ and average HIV viral load of 180,000 ($SD = 13,131.19$ copies/ml; 45,000 – 180,000) copies/ml; 85% had a viral load under 48 copies/ml which indicates excellent suppressed viremia. A CD4+ T lymphocyte count below 200 cells/mm³ is considered to be a useful proxy for the presence of AIDS (Sabin et al., 2010); 10% of participants had CD4+ T lymphocyte counts below 200 cells/mm³.

Training Effects

Participants spent on average 8.20 ($SD = 3.43$; range 0 – 11) hours engaged with this cognitive training protocol; two participants did not use the program at all. Table 2 shows the means for pre-test and post-test performances on the UFOV[®], Wisconsin Card Sorting Test, Finger Tapping Test, and the Timed IADL Test for this sample of middle-aged and older adults with HIV. Lower scores on the UFOV[®] posttest indicate participants improved in visual speed of processing and attention following completion of the home-based speed of processing training; this was statistically significant ($t(14) = 2.80$, $p = .01$, $d = 0.44$). In addition, there was a significant improvement on the Timed IADL Test, ($t(14) = 2.14$, $p = .05$, $d = 0.22$). Albeit, there was a small increase in the mean score on the Finger Tapping Test at posttest compared to the pretest which indicates the participants experienced slight improvements in psychomotor ability, although not statistically significant. Participants performed nearly the same on the Wisconsin Card Sorting pretest as they did on the posttest.

Feasibility, Feedback, and Attrition

In spite of a 25% attrition rate, 15 participants completed the posttest. Non-significant chi-square and t -test analyses indicate attrition was not influenced by gender, minority status, age, income, education, and baseline UFOV[®] performance. Four-to-six weeks after completing the speed of processing training, participants were asked to respond to a survey using the Likert-scale (1 = *not at all*, 5 = *extremely*). As seen in Table 3, of the 15 participants who completed the intervention, 13 of them completed the exit survey; the two participants who did not were the ones who did not upload the software onto their home computer. When asked “*How much did you enjoy these games?*” most participants seemed to moderately enjoy the games ($M = 3.69$; $SD = 1.03$). Participants were asked, “Do you feel these games improved your: (a) mental abilities, (b) memory, (c) speed of processing, and (d) attention?” In general, participants felt the training moderately improved their mental abilities ($M = 3.77$; $SD = 0.93$), memory ($M = 3.54$; $SD = 1.05$), speed of processing ($M = 3.77$; $SD = 0.83$), and attention ($M = 4.08$; $SD = 0.76$).

Eleven of the participants elaborated on their likes and dislikes about the home-based speed of processing training. For example, participants were asked, “*What did you like most about the games?*”; one participant responded, “Challenging, helps with peripheral vision and focus; also works on your memory.” Another participant responded, “*They were fun.*” Other responses included: “Liked car game”; “Thought it increased memory, fun, interesting”; and “Felt it helped brain and vision.” A few of the participants felt the instructions were confusing. Some of general comments about the speed of processing training were: “*I enjoyed it all*”; “Really enjoyed it, felt it helped my mental ability”; and recommended that in the future, the manufacturer should “Make it easier/more consistent to register and set up.”

Discussion

This study was performed to determine if home-based speed of processing training could improve function in middle-aged and older adults. We found that participants scored significantly higher on the UFOV[®] upon completion of the home-based speed of processing training. This finding demonstrates it is possible for middle-aged and older adults with HIV to benefit from speed of processing training even when there is a change in treatment delivery location. In the current study, the mean UFOV[®] improvement was 121.12 ms while the in person mean UFOV[®] improvement from the previous study was 212.41 ms (Vance et al., 2012); this suggests that the home-based training may be less effective than in person training even though a significant improvement occurred. Also, participants improved on the Timed IADL Test; this demonstrates transfer of the training effect onto a laboratory measure of everyday functioning. The speed of processing training was also shown to improve performance on the Timed IADL Test for the in person training with middle-aged and older adults with HIV (Vance et al.) as well as in normal community-dwelling older adults (Edwards, Wadley, Myers, Roenker, Cissell, & Ball, 2002).

For the Finger Tapping Test, there was very little change between the pretest and posttest scores, which was expected because this intervention was not designed to improve psychomotor function. Likewise, the speed of processing training did not influence performance on the Wisconsin Card Sorting measure, a measure of executive functioning. Again, this is not surprising given it has been shown that speed of processing training may not improve functioning in other cognitive domains (Ball et al., 2002; Edwards et al., 2002). Nevertheless, the speed of processing training achieved its primary goal of improving speed of processing performance which may translate to safer driving and improved everyday functioning. For example, Ball and colleagues (2007) found that such training can improve problem-solving ability, visual memory, and driving performance. In a similar study, speed of processing training augmented UFOV[®] performance and instrumental activities of daily living in middle-aged and older adults with HIV (Vance et al., 2014); this is especially important given that poor UFOV[®] was significantly associated with poorer driving simulator performance in middle-aged and older adults with HIV (Vance et al.).

A secondary aim of this study involved determining the feasibility of the cognitive home-based training by evaluating participant feedback, participant outcomes, and attrition. This was accomplished using a qualitative approach to learn how the participants felt about their

training experience. Of the participants who completed the exit survey, 55% felt the speed of processing training improved their memory, attention, and mental abilities moderately or greater. In general, the participants seemed to enjoy these computer exercises and felt it was challenging. The study results and positive feedback from participants are encouraging and suggest home-based speed of processing can be effectively implemented in various settings, including the home, to improve cognitive health in people aging with HIV.

For this study, the attrition rate of 25% was rather high but was not all that different from our in person laboratory-based training protocol of 19.30% (Vance et al., 2012). In fact, in our previous study, there was not differential attrition between the speed of processing group and our control group. Given that we did not have as much contact with participants since they did not come to the clinic for training, it is understandable why the attrition rate of the current study is slightly higher, but not radically different from the previous study. Numerous attempts to contact participants for follow-up were unsuccessful, thus making it impossible to determine if they benefited from the speed of processing training.

Limitations/Strengths

As with all studies, there are endemic limitations and strengths. First, the small sample size of this pilot study limits its generalizability to the larger HIV population. Second, this study lacked a true control group; however, our prior study using speed of processing training in middle-aged and older adults with HIV in a laboratory setting employed a control group and demonstrated significant cognitive gains from this cognitive training protocol (Vance et al., 2012). Given that prior finding, the cognitive gain observed in this within-group design is further supported. Third, participants were paid for each hour of training; it is possible that some malingering occurred in the amount of training reported. Fourth, given the statistically significant cognitive gain observed with such a small sample size in the current study also supports the positive effects of the training protocol itself. Finally, positive feedback from the participants is encouraging in that such a cognitive training protocol may be used effectively for this population in their homes. Home-based speed of processing interventions may be beneficial for adults who fear unsolicited disclosure of HIV status, and those who fail to seek healthcare services because of HIV-related stigma that exists in some communities and healthcare settings (Florom-Smith & De Santis, 2012).

Nursing Implications

Nurses play a major role in promoting engagement in alternative forms of cognitive remediation therapies such as home-based speed of processing training to help patients improve cognitive functioning. Nurses should be knowledgeable of alternative cognitive remediation therapies so that they may educate others and distribute such training to adults who prefer to receive HIV-related healthcare services in a remote setting rather than a clinic. It is essential for nurses to teach patients and families about cognitive health and non-pharmacological measures to slow cognitive aging, particularly in the aging population where the ability to metabolize drugs is greatly reduced. Nurses are positioned to collaborate with other healthcare providers to incorporate cognitive remediation therapies in various settings in effort to encourage optimal physical function and emotional stability, key components of successful aging (Vance, McGuiness, Musgrove, Orel, & Fazeli, 2011).

Conclusion

In response to the growing number of people aging with HIV, speed of processing training may be used to help people manage cognitive dysfunction and promote successful aging. Since speed of processing training has been shown to improve IADLs including driving (Ball, Edwards, & Ross, 2007; Vance et al., 2012), such training could be effective in improving other activities such as medication adherence or remembering to attend clinic visits. Also, since the speed of processing training is easily accessible and can be administered in various venues, this can make it more conducive for patients. Furthermore, issues with the nursing shortage makes the computerized home-based speed of processing training a better option for overly burdened staff who do not have time or resources to administer such training in person (Vance, McNeese, & Meneses, 2009). Thus, new forms of cognitive remediation therapy and benefits of using alternative settings are worth exploring in future studies, with a particular focus on ascertaining their efficacy and durability, as well translation to everyday function and approaches for successfully implementing cognitive remediation into people's everyday lives

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Table 1Sample Description (*N* = 20)

Variable	Mean (<i>SD</i>)	<i>N</i> (%)
Age (years)	50.22 (6.57)	
Education (years)	13.50 (2.04)	
Gender		
Female		5 (25%)
Male		15 (75%)
Race/Ethnicity		
African American		14 (70%)
Caucasian		5 (25%)
Hispanic		1 (5%)
Years with HIV	15.57 (6.09)	
CD4+ Lymphocyte Count (cells/mm ³)	483.17 (262.40)	
HIV Plasma Viral Load (copies/ml)	180,000 (13,131.19)	
Number on cART		19 (95%)

Notes. cART = combination antiretroviral therapy; *SD* = standard deviation.

Table 2Results of Cognitive Measures ($N = 20$)

Variable	Mean (<i>SD</i>)	Pretest-Posttest (<i>p</i> -value)
Useful Field of View Test (milliseconds)		
Pretest/Baseline	618.65 (275.69)	.01
Posttest	497.53 (268.96)	
Wisconsin Card Sorting (% correct)		
Pretest/Baseline	66.90 (13.50)	ns
Posttest	70.13 (14.35)	
Finger Tapping Test (no. correct)		
Pretest/Baseline	46.73 (9.23)	ns
Posttest	48.14 (8.87)	
Timed IADL Test (seconds)		
Pretest/Baseline	101.19 (76.04)	.05
Posttest	86.04 (57.44)	
Engaged in Training Protocol (hours)	8.20 (3.93)	

Notes. IADL = instrumental activities of daily living; ns = not significant; *SD* = standard deviation. Twenty participants were enrolled at baseline; only 15 participants returned for the posttest assessment.

Table 3Self-reported Cognitive Gains from Home-based Speed of Processing Training ($N = 13$)

Exit Survey Questions	Mean (SD)
How much did you enjoy these games? (<i>1 = not at all; 5 = extremely</i>)	3.69 (7.05)
Do you feel these games improved your mental abilities? (<i>1 = not at all; 5 = extremely</i>)	3.77 (0.93)
Do you feel these games improved your memory? (<i>1 = not at all; 5 = extremely</i>)	3.54 (1.05)
Do you feel these games improved the speed in which you process information? (<i>1 = not at all; 5 = extremely</i>)	3.77 (0.83)
Do you feel these games improved your attention? (<i>1 = not at all; 5 = extremely</i>)	4.08 (0.76)

Notes. *SD* = standard deviation. Range: *1 = not at all; 2 = a little; 3 = moderately; 4 = very much; 5 = extremely*. Two participants did not use the training protocol at all; therefore, they could not respond to these questions. Out of the 15 participants who returned for the posttest assessment, only 13 ever engaged in some amount of the speed of processing training.