Annals of Depression and Anxiety

Austin Publishing Group

Open Access Full Text Article

Review Article

Can Speed of Processing Training Ameliorate Depressive Symptomatology in Adults with HIV?

David E Vance*, Shameka C Humphrey, William C Nicholson and Rita Jablonski-Jaudon

School of Nursing, University of Alabama at Birminghom, USA

***Corresponding author:** David E Vance, School of Nursing, Room 2M026, 1701 University Boulevard, University of Alabama at Birmingham, Birmingham, AL 352941210, USA, Tel: 2059347589; Fax: 2059967183; Email: devance@uab.edu

Received: August 13, 2014; **Accepted:** September 02, 2014; **Published:** September 04, 2014

Abstract

Despite advances in combination Antiretroviral Therapy (cART), adults with HIV continue to experience cognitive impairments. In addition to these cognitive impairments, research suggests as many as 40% and 20% of adults with HIV are diagnosed with depression and anxiety, respectively. The impact of these cognitive and emotional deficits increases caregiver burden, impairs occupational and driving performance, contributes to poor emotional processing, increases cognitive complaints, and reduces quality of life. Fortunately, cognitive remediation therapy improves targeted cognitive abilities along with general cognitive processes. Speed of processing training, a type of cognitive remediation therapy, has been shown to improve cognitive performance on measures of visual attention, speed of processing, and timed-task performances. Furthermore, studies suggest that speed of processing training could also enhance neuromodulatory systems which have direct implications for improving mood functions (depression and anxiety). The benefits of the improvement in these cognitive and emotional systems are a decrease or slowing in cognitive decline along with the potential to protect against clinically significant depressive symptoms. Studies support the need for deeper investigation into the short-term and long-term benefits of speed of processing training as a behavioral adjunct for the pharmacologically-burdened HIV population.

Can Speed of Processing Training Ameliorate

Depressive symptomatology in adults with HIV?

Receiving a diagnosis of Human Immunodeficiency Virus (HIV), which remains a highly stigmatized disease, can create enormous emotional distress. For example, in a cross-sectional sample of 1,478 adults from a university HIV/AIDS clinic, Vance and colleagues observed that across each decade of life, approximately 40% and 20% of patients were diagnosed with depression and anxiety, respectively [1]. Although psychotropic medications and cognitive-behavioral therapies can be effective in treating such mood disturbances, another strategy that may bolster these existing therapies may be cognitive remediation therapy, more specifically – speed of processing training. Thus, the purpose of this brief article is to explain how speed of processing, which has been used in normal community-dwelling older adults, may be used in adults aging with HIV. In fact, such training may not only improve cognitive functioning in adults aging with HIV, it may also have secondary benefits to mood, internal locus of control, and everyday functioning (Figure 1).

Cognitive remediation therapy and speed of processing training

Cognitive remediation therapy is an approach in which a wide variety of mental exercises and activities are designed to improve cognition in children and adults. Cognitive remediation therapy has been used to improve overall general cognition as well as improve more specific cognitive abilities such as executive functioning, memory, language, and speed of processing. This approach can take several forms; these activities can be administered via workbooks, videotapes, computer games, the internet, as well as classroom or group settings, depending on what type of cognitive ability is being targeted for remediation or improvement [2,3].

In the largest longitudinal study involving cognitive remediation in normal community-dwelling older adults (N = 2,802), a speed of processing training protocol used in the Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) Study compared this protocol to those participants randomly assigned to a memory training group, a reason training group, and a no-contact control group. Overall, after as little as 10 hours of training (either computerized or in small didactic group sessions), compared to the no-contact control group these ACTIVE researchers found improvements in cognitive measures in the domain for which participants were trained; however, more robust improvements were observed for speed of processing and reasoning. This past year in a press release, (January 13, 2014), NINR/NIA announced that speed of processing training used in the ACTIVE Study enables "older people to maintain their cognitive abilities as they age," even 10 years after training [4]. This public endorsement by these institutes testifies to the neuro-therapeutic utility, efficacy, and adaptability of this training protocol.

Cognitive Relevance to Adults with HIV

Although HIV-related dementia is not as prevalent as in the past because of widespread use of combination Antiretroviral Therapy (cART), adults with HIV continue to remain susceptible to both cortical and subcortical insults that produce cognitive impairments [5]. The virus causes elevated cortisol levels and inflammation that result in the death of glial cells. Moreover, age-associated co-morbidities, HIV-associated comorbidities, and cART-induced

Vance et al. © All rights reserved

Citation: Vance DE, Humphrey SC, Nicholson WC and Jablonski-Jaudon R. Can Speed of Processing Training Ameliorate Depressive Symptomatology in Adults with HIV?. Ann Depress Anxiety. 2014;1(3): 1013.

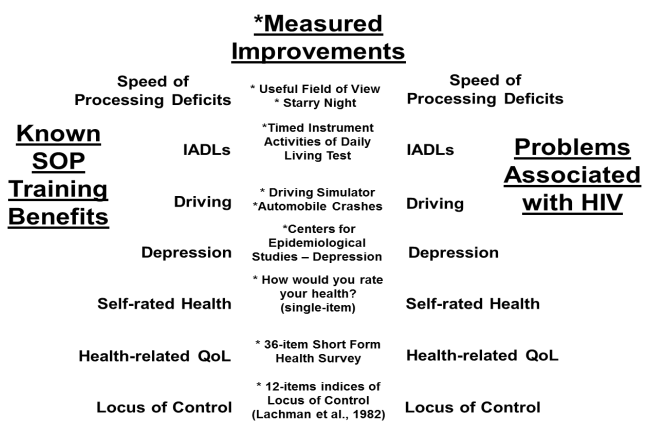

Figure 1: Domains in which Speed of Processing (SOP) Training May Benefit Those with HIV.

metabolic complications (such as hypercholesterolemia and insulin resistance) contribute to additional neurological damage [6]. For instance, in a sample of 1,555 adults with HIV from across the United States, Heaton and colleagues found that 52% experienced HIV-Associated Neurocognitive Disorders (HAND) with 33%, 12%, 5%, and 2% experiencing Asymptomatic Neurocognitive Impairment, Mild Neurocognitive Disorder, Mixed Neurocognitive Disorder, and HIV-Associated Dementia (HAD), respectively [7]. Justice and colleagues found a high prevalence of cognitive impairments in several cognitive domains (e.g., speed of processing, memory) in middle-aged and older veterans with HIV [8]. Others have also found that both viral burden and older age were significant predictors of cognitive impairment [9]. Furthermore, studies have also found cognitive declines and changes in brain functioning in adults with HIV even after only 1 year of infection [10,11]. Co-occurrence of HIV-associated and aging-related cognitive impairments increases the vulnerability of developing cognitive impairments as people age with this disease [12,13]. Wilkie and colleagues administered neurocognitive measures to 81 younger (20-39 years) and 68 older (50+ years) adults with and without HIV [14]. With the use of speed of processing measures, these researchers found that the older adults with HIV performed worse in this cognitive domain than the older adults without HIV and the younger adults with HIV. In a meta-analysis of 41 HIV neurocognitive studies [15], the cognitive domain showing the greatest decline from early to late stages of HIV for all ages was speed of processing.

As noted earlier, adults of all ages with HIV are vulnerable to speed of processing declines [15,16]. As adults living with HIV age, the level of cognitive decline increases. Any decline in speed of processing, even if mild, disrupts other cognitive domains (e.g., memory) [17] and interferes with quality of life, autonomy, and everyday functioning [15]. Speed of processing declines is associated with poorer driving performance outcomes, and more at-fault crashes in normal community-dwelling older adults [18-21] as well as in middle-aged (40+ years) and older adults with HIV [22-24], which represents a growing public health concern.

Speed of processing training in adults with HIV

Fortunately, deficits in speed of processing can be ameliorated. In a two-group pre-post experimental study, Vance and colleagues randomly assigned 46 middle-aged (40+ years) and older adults with HIV into either a no-contact control group or a speed of processing training group [25]. Those in the speed of processing training group received up to 10 hours of computerized exercises specifically designed to improve the rate and accuracy in which one can visually process information. After approximately 5-6 weeks of training, all participants were reassessed on cognitive and everyday functioning. Compared to the no-contact control group, those in the speed of processing training group improved on two measures: 1) the Useful Field of View test, which is a measure of visual attention and speed of processing, and 2) the Timed Instrumental Activities of Daily Living Test, which is a laboratory measure of how quickly and accurately one can perform normal everyday tasks (e.g., locating select items on a shelf of food, counting out correct change).

Cognitive aging with HIV

For those aging with HIV, such training may be particularly important. Adults with HIV often experience cognitive impairments which affect safe driving [22], medication adherence [26], and Instrumental Activities of Daily Living (IADLs) [26,27]. For example, in a cross-sectional study, 26 middle-aged (40+) and older adults with HIV were administered: demographic, health, psychosocial and driving habits questionnaires; cognitive assessments; and driving simulator tests. Older age and poorer visual speed of processing performance (i.e., Useful Field of View*) were related to poorer driving performance operationalized as average gross reaction time, more pedestrians hit, and driving outside the lane. More self-reported automobile accidents in the previous 2 years were associated with slower gross reaction time and higher number of collisions in the driving simulator [22]. These cognitive impairments which impact everyday functioning can likewise increase caregiver burden [28,29], impair occupational performance [30], contribute to poorer emotional processing [31,32], increase cognitive complaints [33,34], and reduce quality of life. This is particularly germane given that by 2020, 70% of adults with HIV in the United States will be 50 and older [35] – an aging trend seen worldwide [36].

Fortunately, speed of processing training is a simple, inexpensive, non-pharmacological intervention which improves the rate at which normal community-dwelling older adults process information [37,38], and has been shown to improve performance in driving [20] and instrumental activities of daily living [39]. This computerized training protocol has been demonstrated in both laboratory training and home-based settings to improve speed of processing and instrumental activities of daily living in middle-aged (40+ years) adults with HIV [25,40].

Non-Cognitive Gains from Speed of Processing Training

Based on findings from the ACTIVE Study, speed of processing can improve other health-related outcomes. These outcomes include improved self-rated health [41], shifts to internal locus of control [42], better health-related quality of life [43-45], and protection against depression [46]. As seen in Figure 1, these outcomes also reflect areas that are important to address with adults living with HIV. Such individuals tend to report poor health-related quality of life [47-49], poor self-rated health [50], decreased internal locus of control [48,51], and increased depression [1,47,52]. In fact, when compared

to memory training and reasoning training, speed of processing training positively continued to affect many of these outcomes five years after the initial training. Furthermore, from the ACTIVE Study, speed of processing training was more robust in improving these outcomes compared to memory training and reasoning training over a 1 to 5 year period. For example, using the ACTIVE data, Wolinsky and colleagues examined whether speed of processing training, in addition to improving this cognitive domain as well as everyday functioning (e.g., instrumental activities of daily living such as driving, taking medications, and housekeeping), would improve secondary outcomes [46]. When comparing speed of processing training to a no-contact control group, those who received this training were 30% less likely to exhibit clinically significant increases in depressive symptoms 1 year ($AOR = 0.700$, $p = .012$) and 5 years ($AOR = 0.698$, $p = 0.23$) after training [46]. Using the same analytical procedures, such protective effects were not observed for those who received the same amount of reasoning training or memory training. An explanation for these findings is that speed of processing "operates through sensory motor elaboration and repetition; it is known that procedural tasks like this have a broad pattern of regional brain activation than explicit memory or reasoning tasks" (p.468) [53]. In fact, with the focused engagement of attention and reward systems during such procedural learning activities, this may enhance neuromodulatory system function, resulting in better brain functions associated with mood [54-56]. Therefore, with such improved brain activation and corresponding structural changes, this could decrease or delay the risk of cognitive slowing, which is a significant predictor of overall decline. Since cognitive slowing is prevented or mitigated with speed of processing training, it may also protect against clinically significant depressive symptoms. Using the same analytical procedures, such protective effects were not observed for those who received the same amount of reasoning training or memory training. Because speed of processing training has been shown to protect normal community-dwelling older adults from depressive symptomatology, the same training may be considered as an adjunct therapy with cognitive-behavioral and pharmacological therapies to ameliorate such mood problems in adults with HIV.

Conclusion

Studies show improved speed of processing abilities in the short-term and long-term in normal older adults who receive speed of processing training [37,39,57-59]. Studies also show that this training results in short-term improvements in speed of processing in adults with HIV [25,40]. Despite well-documented HIV cognitive declines, few behavioral approaches have been attempted to improve cognitive functioning in this pharmacologically-burdened population [1]. In fact, pharmacological cognitive interventions produce adverse side effects in a population already experiencing multiple comorbidities [1]. Thus, speed of processing training is highly innovative because it has the potential to improve multiple health domains for people who are aging with HIV. These domains include cognitive functioning, locus of control, depression, and health-related quality of life; [41,42,46,60] clearly, these are all areas needed for intervention in cognitively vulnerable adults with HIV [31].

References

1. Vance DE, Mugavero M, Willig J, Raper JL, Saag MS. Aging with HIV: a cross-sectional study of comorbidity prevalence and clinical characteristics across decades of life. J Assoc Nurses AIDS Care. 2011; 22: 17-25.
2. Vance DE, McNees P, Meneses K. Technology, cognitive remediation, and nursing: directions for successful cognitive aging. J Gerontol Nurs. 2009; 35: 50-56.
3. Vance DE, Wright MA. Positive and negative neuroplasticity: implications for age-related cognitive declines. J Gerontol Nurs. 2009; 35: 11-17.
4. Rebok GW, Ball K, Guey LT, Jones RN, Kim HY, King JW, et al. Ten-year effects of the advanced cognitive training for independent and vital elderly cognitive training trial on cognition and everyday functioning in older adults. J Am Geriatr Soc. 2014; 62: 16-24.
5. Vance DE. Cortical and subcortical dynamics of aging with HIV infection. Percept Mot Skills. 2004; 98: 647-655.
6. Valcour VG, Shikuma CM, Watters MR, Sacktor NC. Cognitive impairment in older HIV-1-seropositive individuals: prevalence and potential mechanisms. AIDS. 2004; 18: 79-86.
7. Heaton RK, Clifford DB, Franklin DR, Woods SP, Ake C, Vaida F, et al. HIV-associated neurocognitive disorders persist in the era of potent antiretroviral therapy: CHARTER Study. Neurology. 2010; 75: 2087-2096.
8. Justice AC, McGinnis KA, Atkinson JH, Heaton RK, Young C, Sadek J, et al. Psychiatric and neurocognitive disorders among HIV-positive and negative veterans in care: Veterans Aging Cohort Five-Site Study. AIDS. 2004; 18: 49-59.
9. Cherner M, Ellis RJ, Lazzaretto D, Young C, Mindt MR, Atkinson JH, et al. Effects of HIV-1 infection and aging on neurobehavioral functioning: preliminary findings. AIDS. 2004; 18: 27-34.
10. Babiloni C, Vecchio F, Buffo P, Onorati P, Muratori C, Ferracuti S, et al. Cortical sources of resting-state EEG rhythms are abnormal in naïve HIV subjects. Clin Neurophysiol. 2012; 123: 2163-2171.
11. Lentz MR, Kim WK, Kim H, Soulas C, Lee V, Venna N, et al. Alterations in brain metabolism during the first year of HIV infection. J Neurovirol. 2011; 17: 220-229.
12. Valcour V, Shikuma C, Shiramizu B, Watters M, Poff P, Selnes O, et al. Higher frequency of dementia in older HIV-1 individuals: the Hawaii Aging with HIV-1 Cohort. Neurology. 2004; 63: 822-827.
13. Valcour V, Shikuma C, Shiramizu B, Watters M, Poff P, Selnes OA, et al. Age, apolipoprotein E4, and the risk of HIV dementia: the Hawaii Aging with HIV Cohort. J Neuroimmunol. 2004; 157: 197-202.
14. Wilkie FL, Goodkin K, Khamis I, van Zuilen MH, Lee D, Lecusay R, et al. Cognitive functioning in younger and older HIV-1-infected adults. J Acquir Immune Defic Syndr. 2003; 33: 93-105.
15. Reger M, Welsh R, Razani J, Martin DJ, Boone KB. A meta-analysis of the neuropsychological sequelae of HIV infection. J Int Neuropsychol Soc. 2002; 8: 410-424.
16. Hardy DJ, Vance DE. The neuropsychology of HIV/AIDS in older adults. Neuropsychol Rev. 2009; 19: 263-272.
17. Clay OJ, Edwards JD, Ross LA, Okonkwo O, Wadley VG, Roth DL, et al. Visual function and cognitive speed of processing mediate age-related decline in memory span and fluid intelligence. J Aging Health. 2009; 21: 547-566.
18. Wadley VG, Okonkwo O, Crowe M, Vance DE, Elgin JM, Ball KK, et al. Mild cognitive impairment and everyday function: an investigation of driving performance. J Geriatr Psychiatry Neurol. 2009; 22: 87-94.
19. Vance DE, Roenker DL, Cissell GM, Edwards JD, Wadley VG, Ball KK. Predictors of driving exposure and avoidance in a field study of older drivers from the state of Maryland. Accid Anal Prev. 2006; 38: 823-831.
20. Edwards JD, Myers C, Ross LA, Roenker DL, Cissell GM, McLaughlin AM, et al. The longitudinal impact of cognitive speed of processing training on driving mobility. Gerontologist. 2009; 49: 485-494.
21. Friedman C, McGwin G, Ball KK, Owsley C. Association between higher order

visual processing abilities and a history of motor vehicle collision involvement by drivers ages 70 and over. Invest Ophthalmol Vis Sci. 2013; 54: 778-782.

22. Vance DE, Fazeli PL, Ball DA, Slater LZ, Ross LA. Cognitive functioning and driving simulator performance in middle-aged and older adults with HIV. J Assoc Nurses AIDS Care. 2014; 25: 11-26.

23. Marcotte TD, Lazzaretto D, Scott JC, Roberts E, Woods SP, Letendre S. HNRC Group . Visual attention deficits are associated with driving accidents in cognitively-impaired HIV-infected individuals. J Clin Exp Neuropsychol. 2006; 28: 13-28.

24. Foley JM, Gooding AL, Thames AD, Ettenhofer ML, Kim MS, Castellon SA, et al. Visuospatial and attentional abilities predict driving simulator performance among older HIV-infected adults. American journal of Alzheimer's disease and other dementias. 2013.

25. Vance DE, Fazeli PL, Ross LA, Wadley VG, Ball KK. Speed of processing training with middle-age and older adults with HIV: a pilot study. J Assoc Nurses AIDS Care. 2012; 23: 500-510.

26. Thames AD, Kim MS, Becker BW, Foley JM, Hines LJ, Singer EJ, et al. Medication and finance management among HIV-infected adults: the impact of age and cognition. J Clin Exp Neuropsychol. 2011; 33: 200-209.

27. Vance DE, Fazeli PL, Gakumo CA. The impact of neuropsychological performance on everyday functioning between older and younger adults with and without HIV. J Assoc Nurses AIDS Care. 2013; 24: 112-125.

28. Meadows J, Le Maréchal K, Catalán J. The burden of care: the impact of HIV-associated dementia on caregivers. AIDS Patient Care STDS. 1999; 13: 47-56.

29. Lin F, Vance DE, Gleason CE, Heidrich SM. Caring for older adults with mild cognitive impairment: an update for nurses. J Gerontol Nurs. 2012; 38: 22-35.

30. Twamley EW, Narvaez JM, Sadek JR, Jeste DV, Grant I, Heaton RK. Work-related abilities in schizophrenia and HIV infection. J Nerv Ment Dis. 2006; 194: 268-274.

31. Vance DE. The cognitive consequences of stigma, social withdrawal, and depression in adults aging with HIV. J Psychosoc Nurs Ment Health Serv. 2013; 51: 18-20.

32. Hardy DJ, Castellon SA, Hinkin CH, Levine AJ, Lam MN. Sensation seeking and visual selective attention in adults with HIV/AIDS. AIDS Behav. 2008; 12: 930-934.

33. Woods SP, Carey CL, Moran LM, Dawson MS, Letendre SL, Grant I, et al. Frequency and predictors of self-reported prospective memory complaints in individuals infected with HIV. Archives of clinical neuropsychology: the official journal of the National Academy of Neuropsychologists. 2007; 22: 187-195.

34. Vance DE, Ross LA, Downs CA. Self-reported cognitive ability and global cognitive performance in adults with HIV. J Neurosci Nurs. 2008; 40: 6-13.

35. Aging USSS Co. Hearing: Older Americans: The Changing Face of HIV/AIDS in America. One Hundred Thirteenth Congress, first session. Washington, CC. 2013.

36. Joseph J, Achim CL, Boivin MJ, Brew BJ, Clifford DB, Colosi DA, et al. Global NeuroAIDS roundtable. J Neurovirol. 2013; 19: 1-9.

37. Vance DE, Dawson J, Wadley VG, Edwards JD, Roenker DL, Rizzo M, et al. The Accelerate Study: The longitudinal effect of speed of processing training on cognitive performance of older adults. Rehabilitation Psychology. 2007; 51: 89-96.

38. Edwards J, Wadley V, Myers Re, Roenker DL, Cissell G, Ball K. Transfer of a speed of processing intervention to near and far cognitive functions. Gerontology. 2002; 48: 329-340.

39. Edwards JD, Wadley VG, Vance DE, Wood K, Roenker DL, Ball KK. The impact of speed of processing training on cognitive and everyday performance. Aging & mental health. 2005; 9: 262-271.

40. Humphrey SC, Fazeli PL, Vance DE. Feasibility of a home-based speed of processing training program in middle-aged and older adults with HIV. J Neurosci Nurs. In press.

41. Wolinsky FD, Mahncke H, Vander Weg MW, Martin R, Unverzagt FW, Ball KK, et al. Speed of processing training protects self-rated health in older adults: enduring effects observed in the multi-site ACTIVE randomized controlled trial. Int Psychogeriatr. 2010; 22: 470-478.

42. Wolinsky FD, Vander Weg MW, Martin R, Unverzagt FW, Willis SL, Marsiske M, et al. Does cognitive training improve internal locus of control among older adults? J Gerontol B Psychol Sci Soc Sci. 2010; 65: 591-598.

43. Wolinsky FD, Unverzagt FW, Smith DM, Jones R, Wright E, Tennstedt SL. The effects of the ACTIVE cognitive training trial on clinically relevant declines in health-related quality of life. J Gerontol B Psychol Sci Soc Sci. 2006; 61: 281-287.

44. Wolinsky FD, Unverzagt FW, Smith DM, Jones R, Stoddard A, Tennstedt SL. The ACTIVE cognitive training trial and health-related quality of life: protection that lasts for 5 years. J Gerontol A Biol Sci Med Sci. 2006; 61: 1324-1329.

45. Evans S, Ferrando SJ, Rabkin JG, Fishman B. Health locus of control, distress, and utilization of protease inhibitors among HIV-positive men. J Psychosom Res. 2000; 49: 157-162.

46. Wolinsky FD, Vander Weg MW, Martin R, Unverzagt FW, Ball KK, Jones RN, et al. The effect of speed-of-processing training on depressive symptoms in ACTIVE. J Gerontol A Biol Sci Med Sci. 2009; 64: 468-472.

47. Morgan EE, Iudicello JE, Weber E, Duarte NA, Riggs PK, Delano-Wood L, et al. Synergistic effects of HIV infection and older age on daily functioning. J Acquir Immune Defic Syndr. 2012; 61: 341-348.

48. Slater LZ, Moneyham L, Vance DE, Raper JL, Mugavero MJ, Childs G. Support, stigma, health, coping, and quality of life in older gay men with HIV. J Assoc Nurses AIDS Care. 2013; 24: 38-49.

49. Moore RC, Fazeli PL, Jeste DV, Moore DJ, Grant I, Woods SP. HIV Neurobehavioral Research Program (HNRP) Group. Successful cognitive aging and health-related quality of life in younger and older adults infected with HIV. AIDS Behav. 2014; 18: 1186-1197.

50. Vance DE. Self-rated emotional health in adults with and without HIV. Psychol Rep. 2006; 98: 106-108.

51. Vance DE, Moneyham L, Farr KF. Suicidal ideation in adults aging with HIV: neurological and cognitive considerations. J Psychosoc Nurs Ment Health Serv. 2008; 46: 33-38.

52. Vance DE, Moneyham L, Fordham P, Struzick TC. A model of suicidal ideation in adults aging with HIV. J Assoc Nurses AIDS Care. 2008; 19: 375-384.

53. Cabeza R, Nyberg L. Imaging cognition II: An empirical review of 275 PET and fMRI studies. J Cogn Neurosci. 2000; 12: 1-47.

54. Gold PE. Acetylcholine modulation of neural systems involved in learning and memory. Neurobiol Learn Mem. 2003; 80: 194-210.

55. Wise RA. Dopamine, learning and motivation. Nat Rev Neurosci. 2004; 5: 483-494.

56. Wise RA. Rewards wanted: Molecular mechanisms of motivation. Discov Med. 2004; 4: 180-186.

57. Ball K, Berch DB, Helmers KF, Jobe JB, Leveck MD, Marsiske M, et al. Effects of cognitive training interventions with older adults: a randomized controlled trial. JAMA. 2002; 288: 2271-2281.

58. Ball KK, Ross LA, Roth DL, Edwards JD. Speed of processing training in the ACTIVE study: how much is needed and who benefits? J Aging Health. 2013; 25: 65-84.

59. Wadley VG, Benz RL, Ball KK, Roenker DL, Edwards JD, Vance DE. Development and evaluation of home-based speed-of-processing training for older adults. Arch Phys Med Rehabil. 2006; 87: 757-763.

60. Wolinsky FD, Mahncke HW, Weg MW, Martin R, Unverzagt FW, Ball KK, et al. The ACTIVE cognitive training interventions and the onset of and recovery from suspected clinical depression. J Gerontol B Psychol Sci Soc Sci. 2009; 64: 577-585.