Title: A Physical Exercise Program Significantly Boosts the Impact of Cognitive Training on Attention Deficits after a First Episode of Schizophrenia

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Abstract text – 2744 characters without spaces (limit is 3200 characters without spaces)

Background: Systematic cognitive training and physical exercise interventions have been shown to improve the severe cognitive deficits of individuals with schizophrenia to a moderate degree. Our initial smaller study suggested that adding a physical exercise program to cognitive training has promise for enhancing the impact on cognition by improving learning capacity. Focusing on the period after a first psychotic episode may maximize these intervention effects.

Methods: In a randomized controlled trial, we provided computerized cognitive training using web-based neurocognitive and social cognitive programs from Posit Science, 4 hours/week for 6 months for all participants, monitoring by cognitive coaches. Half of the 100 recent-onset schizophrenia participants were randomized to a physical exercise program and half to a didactic healthy living group with comparable intervention contact. Group physical exercise sessions were led by a certified fitness trainer, typically with 4-6 participants, for two 45-min sessions/week. Participants were also assigned two 30-min sessions/week of individual exercise homework. The group exercise sessions included combined moderate-intensity aerobic conditioning (1-min intervals) and moderate-to-high-intensity strength and calisthenic conditioning (1-min intervals). The MATRICS Consensus Cognitive Battery was administered at baseline and at 3 and 6 months. The amount of exercise was measured with the International Physical Activity Questionnaire and by tallying the number of exercise sessions completed.

Results: Repeated measures ANOVA with 87 participants with complete data demonstrated that Attention/Vigilance was enhanced to a significantly greater extent by the combination of cognitive training and physical exercise than by cognitive training and the healthy living group (T score gain of 4.6 vs. 0.0 over 6 months, F = 4.54, p = 0.012). This differential cognitive improvement was not apparent across all cognitive domains, for which both groups showed notable improvement (F = 26.64, p < .001). The amount of improvement in Attention/Vigilance by 3 months was significantly associated with the number of exercise sessions attended (p = .02) and the intensity of exercise (p= .02) during that period. The gain in Attention/Vigilance by 6 months was significantly predicted by the total metabolic energy expended during exercise (METs) during the first 3 months (p = .04) and the proportion of group exercise sessions attended (p = .01) over 6 months.

Conclusions: Adding a combined aerobic and strengthening exercise program to cognitive training clearly enhances the impact on the core deficit in focused, sustained attention that is present after a first episode of schizophrenia. The gains in focused,

sustained attention over 3 and 6 months are significantly related to the amount and intensity of exercise, consistent with the view that the physical exercise is driving the attentional improvements beyond the effect of cognitive training. Considered with the findings from our initial study, these new results encourage adoption of this treatment combination for improving cognitive deficits in the early course of schizophrenia.