



Effects of exercise-based interventions in severe mental illness: a feasibility study

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Dear Editor,

We examined the feasibility of providing a no-cost physical exercise intervention for psychiatric patients at an urban outpatient treatment center in the USA by applying an exercise protocol first reported in Liu-Ambrose et al. [1].

It is hypothesized that exercise interventions can ameliorate neurocognitive deficits of severe mental illnesses, since physical exercise supports neurogenesis, and vascularization in the hippocampus in healthy individuals [2]. Decreased hippocampal volume [3], and impaired neural plasticity [2] are reliably observed in schizophrenia. These structural changes are associated with cognitive deficits, such as impaired memory [3], which hinder recovery of pre-morbid functioning. Although antipsychotic medications can alleviate positive symptoms of schizophrenia, they are not known to influence the structural recovery of brain regions that affect cognition such as the hippocampus [3]. On the other hand, adjunctive treatments such as exercise-based interventions have been associated with modest changes in cognition [2], reduced recurrence of psychotic symptoms [3], and changes in brain structure [4].

Despite growing evidence of therapeutic efficacy, physical exercise remains under-utilized in American psychiatric care. Some of the hurdles may stem from the scarcity of feasibility data from domestic patient cohorts, variable access to exercise facilities and the lack of manualized exercise protocols for psychiatric populations [5].

The primary goal of our feasibility study was to adapt successful protocols developed in Munich, Germany [6] to a psychiatric day facility in a medium-sized American city, and examine the feasibility and acceptability of this type of intervention.

Following approval from the Institutional Review Board at Vanderbilt University, 15 potentially eligible participants were screened with the Physical Activity Readiness Questionnaire (PAR-Q) [4] to identify pre-existing exclusionary health conditions. Ten adults (ages between 26 and 59) with DSM-4 diagnosis of schizophrenia/schizoaffective disorder ($n = 7$), and Major Depressive Disorder ($n = 3$) were ultimately recruited. Self-reported health histories were verified with each participant's case-manager. All participants gave written informed consent approved by the Vanderbilt University Institutional Review Board. They were unpaid.

The following assessments were conducted at pre- and post- intervention: the Brief Psychiatric Rating Scale (BPRS) [7], Scale for Positive Symptoms (SAPS) [7] and Scale for Negative Symptoms (SANS) [7] to determine symptom severity. Each assessment was conducted by research staff who were not involved with the physical exercise training. We used the CogState computerized battery [7, 8] to assess cognitive domains such as attention, working memory, and visual learning. Finally, the International Physical Activity Questionnaire (IPAQ) [2, 9] was used to estimate the amount of exercise, and other physical activities of daily living each participant engaged in, and the 6-Minute Walk Test (6-MWT) [10]—which measures how long participants can maintain a moderate walking pace without fatigue—indexed general cardiovascular fitness.

Participants were non-randomly assigned to exercise groups; on-site case-managers accompanied study staff with descriptions of both programs, and participants were allowed to choose their preferred program. This accommodation was made to improve the probability that participants would comply with their assigned intervention. Group A was assigned to the “Balance and Tone” program [6]—which consisted of assorted exercises intended to develop muscular endurance, and balance—as the control condition. We modified the published protocol to alternate between two set exercise routines in sessions across the intervention period. Group B was assigned to a movement therapy protocol

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of selected activities utilized at the Clinic for Psychiatry and Psychotherapy at Ludwig-Maximilians-University of Munich to improve coordination, proprioception, and social engagement. In one session, for example; participants were asked to make groups of four, and initiate eye-contact before passing different types of balls (foam-, tennis-, and volleyballs) among the group. Participants needed to adjust their throwing and catching technique to be successful in each round of the activity. The Balance and Tone protocol provided modifications for each exercise to accommodate participants with variable levels of physical fitness. For example; participants who were unable to maintain balance on one leg were permitted to use a wall for support during balance exercises. Over 8 weeks, participants attended 1-hr-long exercise sessions on the the day assigned to their respective groups. Both groups engaged in an identical warm-up protocol consisting of light jogging, and stretching. Participants were required to attend seven out of ten sessions to advance to post-intervention assessments.

70% of subjects completed their respective programs. The majority of participants in both groups reported restricted access to exercise on the IPAQ. 50% of the participants were employed but only two participants worked full time. 70% did household chores that required light- to moderate levels of physical activity (sweeping, laundry) for an average of 15–20 min per session. Motor vehicles were the primary mode of transport for all participants, but 80% reported walking for an average of 46 min per day. Both groups endorsed similar amounts of daily sedentary time on weekdays and weekends, (Group A: 5.7 hr per weekday; 6.9 hr per day on weekends; Group B: 5.8 hr per weekday; 6.6 hr per day on weekends). There was no statistically significant difference in distances covered in the 6-Minute Walk Test after either intervention relative to baseline performance. Further, neither intervention had a statistically significant effect on Cogstate performance across any tested domains, and the change in severity ratings of positive/negative symptoms were also not statistically significant.

Our small sample size does not yet allow us to test for the effects of these interventions on cognition, or mood- and psychotic symptoms. However; the successful completion of two different exercise-based interventions in a sample of American adults with severe mental illness is promising. It is particularly significant considering that the majority of subjects reported restricted access to regular physical activity outside of their participation in the study. Exercise may prove to be a useful adjunct treatment modality in contemporary psychiatric care, though additional study will be necessary to determine best practices in protocol design [2]. The duration, frequency, and intensity of exercise sessions may influence the extent of impacts on both brain structure,

and symptoms, thus certain types of exercise may be more beneficial than others [5]. Adjustments to the two utilized protocols, such as increasing the number of weekly exercise sessions could lead to observable effects on neurocognitive deficits. Further iterations of this study should address additional contributing factors to physical fitness such as diet, and control for the commonly prescribed psychotropic medications.

Compliance with ethical standards

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

Ethical approval Our protocol was approved by our institution's IRB.

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