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Cardiorespiratory Benefits of Group Exercise among Adults with Serious Mental Illness

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Abstract

This study examined cardiorespiratory fitness (CRF) among adults with serious mental illness (SMI) participating in group exercise classes. Overweight and obese adults with SMI were randomized to either a control condition or a weight management condition with group exercise classes (n=222). Submaximal bicycle ergometry was used to assess CRF at baseline, 6 and 18 months. Those with 66% participation in the exercise classes had a lower heart rate response at 6 and 18 month follow-up. Participation in group exercise classes was associated with improved short and long term cardiovascular fitness among adults with SMI.

Keywords

Cardiorespiratory Fitness; Physical Activity; Serious Mental Illness

1. Introduction

Adults with serious mental illness (SMI) have high rates of obesity, cardiovascular disease, metabolic syndrome, and three times the risk of early mortality compared to the general population.(Daumit et al., 2010, Vancampfort et al., 2015a, Vancampfort et al., 2015b) Regular physical activity has been shown to address these health issues.(U.S. Department of Health and Human Services, 2008) Yet those with serious mental illness have lower physical activity levels than the general population. (Ussher et al., 2007, Daumit et al., 2005, Stubbs, et al., 2016, Vancampfort et al., 2012) Despite the growing body of evidence that exercise programs are being conducted with this population, evaluation of long term changes in cardiorespiratory fitness (CRF) from these programs are scant. (Firth et al., 2015,

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Vancampfort et al., 2015c, Vancampfort et al., 2017, Pearsall et al., 2014) As aerobic conditioning is effective in improving CRF which in turn is associated with decreased cardiovascular disease it serves as a modifiable factor with a large potential impact on this population. (Vancampfort et al., 2017) Although efforts to increase CRF in persons with serious mental illness have included a range of modalities, group exercise, despite being a mainstream offering in commercial markets, has been largely absent from the literature.

The Achieving Healthy Lifestyles in Psychiatric Rehabilitation (ACHIEVE) randomized controlled trial incorporated group exercise as a fundamental component of an 18-month lifestyle-based weight loss program conducted in community settings for adults with serious mental illness. (Casagrande et al., 2010) These secondary analyses examine CRF by baseline characteristics and changes in CRF by randomization condition and level of group exercise participation.

2. Methods

2.1 Participants

Participants were randomized to either a control condition or a weight management condition with group exercise classes. The study design details and main results have been published. (Casagrande et al., 2010, Daumit et al., 2013) Inclusion criteria for study participation included age ≥ 18 years, BMI ≥ 25 kg/m², and attendance in a participating psychiatric rehabilitation program. Exclusion criteria included contraindication to weight loss, cardiovascular event (≥ 6 months), inability to walk unaided, and active alcohol/substance disorder. There were standardized assessments of height and weight with psychiatric diagnoses abstracted from program records. (Casagrande et al., 2010, Daumit et al., 2013) Exclusion from these CRF analyses included: taking beta blockers (n=50); medical exclusions from bicycle ergometer testing (n=6); technical difficulties on ergometer (n=7); and insufficient time on ergometer for a heart rate reading at baseline (n=6). Study procedures were approved by the institutional review board, and all study participants provided written informed consent.

2.2 Group exercise classes (exposure)

Group exercise classes were held at the community based psychiatric rehabilitation programs and focused on low impact aerobic conditioning. Classes started at a level appropriate for individuals with low CRF and progressed in intensity and duration reaching 50 minutes of moderate intensity aerobic training per class. During months 1–6 study staff conducted three classes/week (median 61 classes total). In months 7–12 study staff led two classes and mental health staff led one class weekly. During months 13–18 study staff led one and mental health staff led two classes per week. Mental health program staff facilitated classes with the support of an exercise video. There were approximately 1.6 classes per week (median 76 classes total) led by the study staff during months 7–18.

Participation was defined as arriving on time, staying for the entire class, moving during the entire aerobic portion of the exercise class, and only taking breaks as scheduled/indicated by the instructor. Only study staff consistently recorded participation using this definition.

These analyses focus on cumulative attendance in classes led by study staff across all ten sites.

The control condition received standard information of nutrition and physical activity at baseline and were offered quarterly health classes unrelated to weight (e.g. cancer screening).

2.3 Cardiorespiratory fitness (outcome)

Cardiorespiratory fitness was assessed via a submaximal bicycle ergometer test at baseline, 6 months and 18 months. Tests were performed on a Monarch 828E cycle ergometer (Vansbro, Sweden) and started with a brief (< 3 minutes) warm up at zero resistance and 50 rpm followed by three minute stages of increasing resistance (0.5 kg, 1 kg, 2 kg, 3 kg). Tests were stopped for the following: completion of all four stages; achieving 85% of predicted maximal HR ($220 - \text{age}$); volitional fatigue; a drop from resting SBP > 10 mm Hg, SBP > 250 mm Hg, or DBP > 115 mm Hg. Heart rate was used as an indicator of CRF in this submaximal exercise test. (Pescatello et al., 2014, p.74) Heart rate was assessed at the end of each stage and higher cardiorespiratory fitness was indicated by lower heart rate response at the fixed work load (i.e. 0.5 kg at stage 1).

2.4 Analytic plan

Between group differences at baseline were examined using 2-sample t-tests or ANOVAs. Multiple regression was used to examine CRF between randomization conditions and across a range of participation levels corresponding with the attendance patterns we observed. Specifically, two or more classes (e.g. 66%), less than two but at least one (e.g. 33–65%), and less than one class per week (e.g. < 33%). Multiple regression controlled for baseline CRF, age, sex, and BMI. Analyses were conducted using SAS version 9.3 (SAS Institute, Inc., Cary, NC).

3 Results

3.1 Baseline

Among the 291 randomized participants there were 222 with valid scores for a heart rate during stage 1 at baseline. The baseline sample included 50% female, 39% black (vs non-black), an average age of 44.3(11.1) years. Primary diagnoses included 56% schizophrenia/schizoaffective disorder, 25% bipolar, 13% major depressive, and 6% other.

Better cardiorespiratory fitness as indicated by a lower heart rate response was identified for males compared to females (107.0(15.1) vs. 113.1(16.2) bpm, $p=.004$); overweight compared to obese participants (102.2(13.8) vs. 112.2(15.8) bpm, $p<.001$) and those 46 years and older compared to younger participants (106.9(15.7) vs 112.8(15.7) bpm, $p=.006$). There were no baseline CRF differences between race and diagnosis subgroups or between randomization conditions.

3.2. Changes in cardiorespiratory fitness

Results from multivariate regression indicated no differences between randomization conditions in CRF changes at months 6 (n=201) or 18 (n=154). Among the 91 active intervention participants with valid baseline scores there was valid follow-up at 6 months (n=91) and 18 months (n=72). Participation in 66% of exercise groups was associated with decreased heart rate, or improved CRF at 6 months ($p=.007$) and 18 months ($p=.05$) in the intervention condition (Table 1). No changes in CRF were associated with participation rates of <33% or 33–65% at either 6 or 18 months. At 6 months, those with at least 66% participation had significantly improved CRF compared to those with 33–65% participation ($p=0.02$). In addition, at 18 months, those with at least 66% participation compared to those with <33% participation had improved CRF ($p=0.02$)

4. Discussion

Among overweight and obese adults with serious mental illness attending community based rehabilitation programs, participation in group exercise classes (i.e. 66%, or 2 classes per week) significantly increased participants' cardiorespiratory fitness. This cardiorespiratory improvement was found at 6 months, supporting other literature showing physiological benefits from exercise in persons with serious mental illness. (Scheewe et al., 2012, del-Baki et al., 2013, Armstrong et al., 2016) We also identified enhanced cardiorespiratory fitness from group exercise at 18 months thus adding to the nascent evidence of long term cardiorespiratory benefit of exercise in this population. (Bartels et al., 2013) Our 18-month intervention results are important not only for the long length of follow-up, but also due to the nature of the exercise classes in months 7–18. During that time the number of classes taught by study staff decreased and classes led by mental health program staff increased. This suggest that fitness gains realized during the first 6 months were maintained in these community settings through classes facilitated by community program staff.

We also reported lower fitness among females (compared to males) and obese (compared to overweight) adults with SMI which was congruent with both Scheewe et al., (2012) and Heggelund et al., (2011a). Consistency in the literature suggests that within this at-risk population there are subgroups with greater needs related to cardiovascular fitness. Further targeting of interventions should be considered to assist these subgroups. Future studies should determine if CRF is associated with sex related differences in life expectancy. (Chang et al., 201, Colton et al., 2006)

Although participation was associated with statistically significant fitness improvements, even exercise in the high participation group may equate to a suboptimal dose of physical activity. Attending two classes per week (i.e. 66% participation) would have resulted in approximately 100 minutes per week of moderate physical activity. This is less than the national recommendation of 150 minutes of moderate intensity physical activity per week. (U.S. Department of Health and Human Services, 2008) However, we know that even low doses of physical activity are associated with reduction in mortality risk among older adults. (Hupin et al., 2015) Our results indicate that less than recommended levels of physical activity may confer health benefits (i.e. improved CRF) in persons with serious mental illness, however the minimum level of weekly physical activity needed for health benefits

cannot be determined with these data. Studies evaluating the effect of various exercise volumes on intermediate (e.g. CRF) and distal (e.g. morbidity or mortality) outcomes are needed among adults with SMI.

We did not find a treatment effect but rather an effect associated with the level of participation in the exercise classes. Further efforts are needed to help increase adherence to exercise in this population. Additionally, adults with schizophrenia have higher dropout rates from exercise programs compared to the general population and it has been suggested that supervision of exercise aids in retention. (Vancampfort, et al., 2016) The modest improvement in CRF from attending two or more classes per week in the current study is aligned the general physical activity recommendation that “some is better than none”. (U.S. Department of Health and Human Services, 2008) Exercise leaders could use the “some is better than none” message to attenuate dropout among those with intermittent adherence.

We did not find a dose response relationship between participation and fitness but our design likely lacked power for this secondary analysis. The potential bias from loss to follow-up warrants due caution in interpreting these findings. We found the younger participants had lower CRF, yet previously reported findings were aligned with a conventional decline in CRF with age. (Strassnig, M., 2011) A larger study is needed to examine a potential explanatory mechanism linking age and CRF in this population (e.g. survivorship, symptom severity, physical functioning). Strengths of this study include community-based settings; standardized methods used to assess submaximal cardiorespiratory fitness; and an 18-month follow-up. Additionally, the sample included diversity in age, sex, race and primary psychiatric diagnosis likely to be found in community based rehabilitation programs.

There is no one-size-fits-all approach to promoting physical activity among the general population. Similarly, efforts targeting adults with SMI will benefit from employing multiple evidenced-based strategies. These results support the use of tailored group exercise classes in community-based mental health settings to improve the short and long-term cardiovascular fitness of the psychiatric rehabilitation center members. Anecdotally, PRPs were interested in providing group exercise classes after the study ended because this format easily fit with the daily group scheduling and could be offered on site with very little equipment. These findings provide support for physical activity programs to be offered in conjunction with and in the context of other traditional mental health services for adults with serious mental illness. (Vancampfort et al., 2015a, Pratt et al., 2015)

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Highlights

- Group exercise has long-term cardiorespiratory benefits for adults with SMI
- Some aerobic exercise is better than none for adults with SMI
- Physical activity programs can be offered in conjunction with mental health services

Table 1

Changes in Cardiorespiratory Fitness at 6 and 18 Months among Adults with Serious Mental Illness Participating in Group Exercise Classes

Heart Rate Response (bpm)	Group Exercise Participation		
	< 33%	33–65%	66%
Month 6 follow-up	n=41	n=26	n=24
Baseline, M(SD)	109.2 (14.4)	113.7 (17.8)	105.4 (18.4)
Change at 6 months, M(SD)	−1.7(13.1)	−0.1 (10.3)	−5.9(10.5) ^{*b}
Month 18 follow-up	n=33	n=21	n=18
Baseline, M(SD)	108.8 (16.2)	104.5 (17.8)	107.2 (18.5)
Change at 18 months, M(SD)	−0.4 (10.5)	−1.1 (11.0)	−5.9 (11.9) ^{*a}

Note. bpm = beats per minute. Change was calculated (follow-up – baseline). Heart rate response at stage one with 0.5 kg of resistance.

^{*} denotes within group change from baseline $p < .05$.

^a indicates different from < 33% group $p < .05$.

^b indicates different from 33–65% group $p < .05$.