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Group exercise to improve quality of life among substance use disorder patients

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Abstract

Quality of life is a well-established outcome within clinical practice. Despite substance use disorders' adverse effects on a wide range of patients' functioning and the multidimensional composition of quality of life, the treatment field does not yet systematically assess quality of life among patients. Exercise has established positive effects on the quality of life of healthy and numerous clinical populations. The potential to integrate exercise within treatment in order to improve quality of life has not been satisfactorily explored. Aims: To measure changes in quality of life after group exercise among residential substance use disorder patients, and to explore the feasibility of the program within a treatment setting. Methods: Thirty-five patients in four long-term, residential substance use disorder treatment facilities in Oslo enrolled in a 10-week group exercise program. Twenty-four participants exercised and were analyzed as completers, while eleven did not and were analyzed as non-completers. Quality of life, mental distress, somatic health burden, and addiction severity were measured at program start and end. Results: The program was feasible for participants, and the completion rate was 69%. Completers' physical and psychological health quality of life improved significantly. The program engaged the most physically and mentally vulnerable participants, and flexibility and motivational factors were important elements. Conclusions: This study provides promising evidence that low doses of group exercise can yield appreciable benefits, even to patients with more severe health problems. Keywords: substance use disorder, quality of life, WHOQOL-BREF, exercise, physical activity, recovery.

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1. Introduction

Substance use disorders (SUD) are preventable and treatable chronic conditions that affect a wide range of patients' functionings, physical and psychological health, social relationships, and environment [1, 2]. In the past decades' clinical shift away from a pathological model of SUD towards a model including multidimensional health outcomes, quality of life (QoL) has become an attractive and increasingly-measured outcome for the addiction research field [2]. QoL measurements allow persons to appraise functionings not captured by traditional measures of severity [3] as well as their satisfaction with each level of functioning, thereby recognizing the range of negative effects of SUD in a patient's life. Poor QoL is both a determinant and outcome of SUD, useful therefore in diagnostic and predictive capacities in the context of treatment. Diagnostic in that QoL assesses the "lived problems" of SUD better than measuring SUD severity [1, 4], and by requiring/validating patient experiences, captures aspects of disorder and treatment that clinicians miss. Laudet argues that low QoL indicates treatment readiness, as people with a SUD attempt to quit or reduce use to escape the negative effects of SUD and improve their QoL rather than to end SUD for itself. One study has found that higher QoL at treatment completion predicts sustained abstinence one and two years later [5].

In line with measurements such as QoL which capture outcomes beyond substance use, a variety of treatments themselves have been explored which also seek to address and alleviate the range of negative impacts of SUD. Exercise is one such treatment that has successfully impacted substance-related outcomes as well as QoL, anxiety, depression, physical comorbidities, and self-esteem, among others (see Zschucke et for a review [6]). Exercise can reduce the relative reinforcing strength of substances and serve as an alternative, non-substance reinforcer to substance self-administration. Proposed mechanisms include reducing negative affective states identified as "initiating, maintaining, and accelerating" SUD [7] and promoting positive effective states which are associated with low SUD and possibly protect against

SUD [8-10]. When introduced after the onset of SUD, physically active patients are less likely to relapse than sedentary patients [11, 12].

Given high rates of attrition from traditional SUD treatment among this population, successful exercise interventions must proactively attempt to prevent attrition. A wealth of information on adherence practices is available from exercise interventions among the obese, elderly, and other chronically ill populations. Group- and facility-based exercise both appear to be more beneficial than individual- and home-based programs [13], and one meta-analysis found that QoL improved among healthy and clinical patients who exercised in groups, but not among those who used home-based or individual regimens [14]. Financial incentives have also been found to improve exercise adherence in the short term [15]. Finally, the best design suggestions for this pilot study may be existing surveys of exercise preferences among SUD patients. Sedentary SUD patients have identified barriers nearly identical to health populations: high perceived costs of equipment and facilities, low motivation, lack of transportation, lack of time, and low perceived social support [16].

An existing gap in research is the effect of exercise on the QoL of persons with SUD. If exercise can increase QoL, and if improved QoL is a desired outcome of SUD treatment in and of itself as well as a path to improvements in additional outcomes, then the public health gains of integrating exercise into SUD treatment could be sizeable. This study intended to explore the feasibility and QoL effects of group exercise among residential SUD patients through implementing a ten-week, low intensity group exercise program that was voluntary and led by motivating coaches outside of the treatment system.

The research questions were:

1) What is the development of SUD patients' quality of life after participation in a low-intensity, coach-led, group exercise program?
2) Is this program feasible for SUD patients in a treatment setting?

2. Materials and Methods

2.1 Participant sampling

This volunteer-based, non-random sample was recruited from three public and one private post-acute, residential SUD treatment facilities in Oslo. The institutions were the first four to express interest in involvement with the study after meeting with the project leader. Eligible participants were between 18 and 65 years of age, were enrolled in long-term residential SUD treatment, and were sedentary, as defined by having exercised less than 20 minutes per day, three days a week for the past three months. The only exclusion criteria were pregnancy and intended pregnancy. The study protocol was approved by the Norwegian Regional Committees for Medical and Health Research Ethics.

70 patients were present during the coaches' recruitment sessions, of which 35 were recruited. Our sample was comprised of the recruited 35 who contributed data at baseline (the other 35 did not and were therefore not part of the analysis). No exclusions were made.

The sample of participants included 9 (26%) females and 26 (74%) males. The mean age was 41 years (SD = 8). Most participants were of Norwegian or Nordic descent (94%). The majority (62%) had never been married. The largest group of participants (83%) responded that they were neither in the labor market nor studying, and less than 12% were employed either full- or part-time. Nearly 80% of participants had completed secondary education/training or less. Most participants had received previous inpatient (94%) or outpatient (90%) SUD treatment. Sixty-nine percent reported using at least one substance over the six months prior to the intervention, and 50% used at least two. The most commonly used substances over the past six months were benzodiazepines (reported by 41% of participants), alcohol (38%), cannabis (28%), heroin/opiates (25%), and amphetamines (25%). Seventy-seven percent of participants smoked daily. Participants suffered from an average of 20 out of 25 somatic conditions presented, and every participant suffered from at least one. Fifty-five percent of participants reported clinical emotional distress, the same percentage reported clinical depression, and 48% reported clinical anxiety.

Non-completers were defined as participants who did not attend any sessions, and were compared to completers. 23 out of the 24 completers provided data at the program's end, while 8 out of 11 non-completers provided data at the end.

2.2 Group Exercise Intervention

The group exercise program lasted ten weeks. Participants received three 30-minute sessions of coach-led, low-threshold exercise sessions each week. Exercises were grouped into walking/running, ball games, and strength-training sessions. The duration and dose were decided by averaging 32 studies in a meta-analysis investigating the relapse effects of exercise interventions among SUD patients [6]. Sessions began by meeting at each institution so as to avoid the time and cost of traveling as well as to allow last-minute decisions to attend. Only facilities and equipment owned by institutions or publicly available within 1 km were utilized. Participants were not required to spend any money or make any purchases.

Participants set the schedules prior to the program beginning; activity and time changes were also made on a rolling basis according to their requests. Participants were encouraged to attend the amount and type of exercise sessions they liked and to exercise at their preferred exertion. However, the physical benefits of even low-intensity exercise and cumulative sessions were highlighted. Coaches also attempted to directly increase motivation, engagement, and self-confidence among participants through twice-weekly reminders and recognition of progress and accomplishments via SMS. Absent participants received reminders that their presence would be appreciated. Fitness-related non-financial incentives such as monthly memberships to local gyms were used to increase motivation and reward enrollment, attendance, and achievements.

2.3 Measures

The survey instrument measured the main outcome of QoL as well as demographic, physical health, mental health, and substance use variables. It was distributed once at enrollment, week 0, and again at the program's end, week 10.

QoL was measured using the World Health Organizations Quality of Life Brief (WHOQOL-BREF). The WHOQOL-BREF has been validated internationally, multilingually, and among the SUD population [17, 18]. It has shown satisfactory psychometric values in Norwegian population studies [19]. The Hopkins Symptoms Checklist (HSCL-25), a widely used screening tool for emotional distress that includes two subscales for anxiety and depression, measured mental distress [20]. Subscale scores above 1.0 indicate clinical anxiety and clinical depression, and an overall score above 1.0 indicates clinical emotional distress. An increase in any score, by repeated measurements, indicates a worsening of mental distress. Excerpts from the EuropASI collected substance-related variables [21]. Somatic health burden was measured by the amount of somatic conditions participants reported suffering from, out of a list of 25. This list was compiled by senior researchers at the Norwegian Centre for Addiction Research based on their clinical experience, and included common and chronic conditions such as diabetes, hepatitis B and C, cancer, and heart disease.

Program feasibility was explored through attendance data, spontaneous participant feedback during the program, and participants' answers to open-ended questions at the end about program acceptability.

2.4 Analysis

Baseline data were examined for significant between-group differences. Mann-Whitney U tests were used to compare completers and non-completers, as this small sample size did not provide normally distributed data. Baseline variables of somatic health burden, mental distress, and addiction severity, each with established relationships to QoL, violated various requisite assumptions of covariates and therefore none could be added to the model.

Repeated measures analyses of variance were used to analyze the effect of the intervention on each QoL domain. This analysis models QoL at program beginning and end for completers and non-completers. If the two groups' QoL scores changed in statistically different manners, the effect of the interaction between the within-group variable (time) and the between-group variable (exercise) will be

significant. Significance was set at $p<0.05$. The model for each domain met the following assumptions: normal distribution; independence of observations; homogeneity of variance; and homogeneity of intercorrelations. The Greenhouse-Geisser F-tests were used in every model because Mauchly's test of sphericity was violated. Plots of each QoL domain supplement the results and indicate the direction of QoL changes. Repeated measures analyses of variance were also used to analyze changes in clinical anxiety and depression over time.

To assess whether any statistically significant changes attributable to exercise were clinically meaningful, the minimum clinically important difference (MCID) was calculated for each QoL domain as 0.5 of the standard deviation of change [22].

We used SPSS v.21 for Mac for all analyses. Four participants were not available at the program's end; the repeated measures analyses excluded their data. Three participants reported that serious injury or illness during the program impacted their participation; their QoL data has also been excluded.

3. Results

3.1 Group differences at baseline

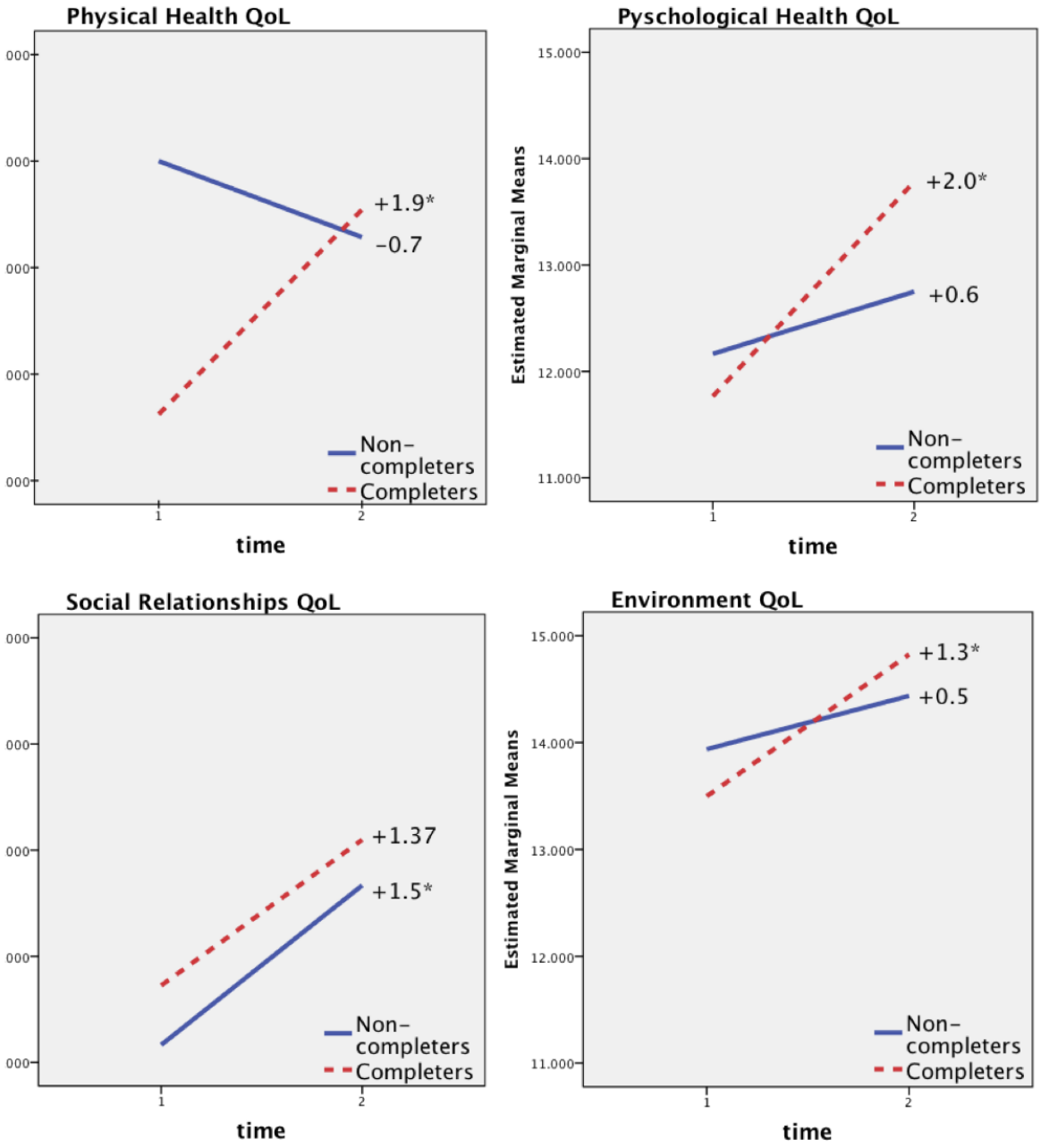
At baseline, completers suffered from more somatic conditions ($p=0.004$) than non-completers, and more completers evidenced mental distress ($p=0.002$) than non-completers. There was no significant difference between the addiction severity of completers and non-completers at baseline.

3.2 Development in QoL

As described, analyses of variance with repeated measures were conducted to analyze the interaction's effects on each QoL domain among completers and non-completers. There was a statistically significant Time x Exercise interaction in the physical health QoL domain, $F(1, 26) = 9.532$, $p=0.005$, with an increase in completers' physical health QoL and a decrease among non-completers. Completers' improvement was above the MCID threshold and therefore clinically significant, while non-completers'

decrease was not. There was also a statistically significant Time x Exercise interaction in the psychological health QoL domain, $F(1, 26) = 5.813$, $p=0.023$, and completers' increase was clinically significant. While both groups increased in the remaining two domains, there were no statistically significant interactions between exercise and time in the social relationships domain, $F(1, 23) = 0.011$, $p=0.919$, or in the environment domain, $F(1, 26) = 0.913$, $p = 0.348$. Despite no statistical significance, the improvement in non-completers' social relationships domain was of clinical significance, as was completers' improvement in their environment domain. There was a significant main effect of time in the psychological health QoL domain, $F(1, 26) = 19.193$, $p<.0005$, partial eta squared = 0.425, that was also clinically significant. The profile plots in Figure 1 show the changes in each domain over time and clinical significance.

Figure 1. Quality of life profile plots: QoL changes over time, per domain



3.3 Development in Clinical Variables

At the conclusion of the program, mental distress had reduced among completers. The percentage of completers reporting anxiety reduced from 74% to 46%, and the percentage with depression reduced from 78% to 36%. Such improvements were not seen among non-completers. 30% of non-completers

reported anxiety at baseline and 25% at conclusion, while 10% began the program with depression and 25% ended with depression. However, neither measure of mental distress changed in a significantly different manner between the two groups, according to analyses of variance with repeated measures: $F(1, 26) = 3.510$, $p=0.072$ for anxiety; $F(1, 26) = 2.849$, $p=0.103$ for depression. Somatic health burden remained unchanged in both groups. Substance use and variety after the intervention decreased for all participants, but more non-completers (63%) reported substance use at program end than completers (26%).

3.4 Program feasibility

Participants exercised for an average of 13.2 (SD=8.3) sessions out of 30, corresponding to one to two sessions per week. Sessions lasted an average of 36 minutes. On any given session, 25% to 65% of all completers attended. Attendance over the course of the intervention increased for two treatment facilities and decreased for two.

The program was received positively by all participants. Best practices, as identified through attendance data and participant-attended strengths, included a) the variety of activities, b) the duration and low intensity of exercise, c) guided sessions by coaches and coach attributes, d) group exercise instead of individual exercise, e) taking participant input into account through rescheduling sessions and selecting activities, f) twice-weekly SMS reminders of sessions, and g) consistent coach encouragement to all participants to attend. Incentives were conspicuously absent among program strengths reported by participants. Specific activities and the prescribed intensity were also identified as weaknesses. The benefits and advantages identified by participants were primarily physical, including: improved fitness and other physiological benefits; the adoption of health behaviors beyond the exercise groups, such as reduced smoking and replacing elevators with stairs; new exercise knowledge; and more energy. Psychological benefits included improved mood and motivation to both exercise and to fulfill daily tasks. No disadvantages to having participated were reported.

Ten participants reported injuries/illnesses over the course of the program. In most cases, it was not possible for participants or for coaches to define the source of the injury/illness as the exercise program. Some participants with injuries reduced their participation, while others requested and received modified sessions.

4. Discussion

Since little is known about exercise's effect on the quality of life of substance use disorder patients, this study engaged four groups of sedentary, residential patients in a 10-week exercise program and investigated QoL changes as well as program feasibility. Our major findings were 1) QoL improved among completers of the exercise program; and 2) this exercise program is feasible for SUD patients within a treatment setting, even for the most physically and mentally vulnerable.

4.1 Improved QoL among completers

Results of exercise's positive impact on physical quality QoL and psychological health QoL are consistent with previous studies among other clinical populations [23, 24]. This consistency suggests that the possibilities for knowledge transfer between successful exercise interventions among other clinical populations and the SUD population can and should be exploited.

To the authors' knowledge, this study is the first to quantitatively measure QoL changes among SUD patients before and after exercising. Similar qualitative effects on QoL were recently reported in Denmark [25]. Group exercise seems to be an effective way to increase SUD patients' valuation of their physical and mental capabilities and functionings even without concurrent health improvements, in the presence of injury, and with enduring somatic and mental health problems. While the social health domain of QoL did not change, feedback emphasizing the utility of social contact during the program was reinforced by attendance patterns: rather than attend according to activities or on certain days, participants appeared to attend within social clusters, that is, when their peers attended. Positive social reinforcement

may be maximized in future interventions through engaging participants' informal social leaders or those who provide the most encouragement to others.

Change in fitness was not measured. It is a possible mediator of one or both domains; however, Martin et al's RCT among middle-aged women concludes that QoL improvements after exercise do not require fitness improvements [26]. The mediation of mental distress on psychological health QoL is more likely, and several meta-analyses and reviews have identified improved mental health outcomes after exercise interventions [27]. While a causal effect of the exercise groups cannot be drawn, the previously discussed psychological benefits of exercise as well as the abundance of preclinical evidence of exercise's protective behavioral effects on SUD [7] are useful in this context as plausible explanations of completers' improved QoL.

4.2 Feasibility and clinical implications

We are satisfied with a completion rate of 69% considering the high attrition rates from exercise programs in general [28] and of SUD patients from standard SUD treatment [6]. Several findings lead us to recommend this type of group exercise as particularly feasible. First, completers experienced improved QoL even after receiving a relatively low dose of exercise; this exercise program has large potential if attendance rates can be increased. Completers attended an average of 44% of sessions available, and the broad inclusion of participants who attended only once into the "completers" group likely yields a conservative effect estimate. Had only participants with over 50% attendance rates, for example, been analyzed as "completers", the effect may have been larger.

Second, most exercise programs succeed in engaging only participants with the fewest health issues [29], yet we managed to encourage completion among participants with the most physical problems and the most severe mental distress. Exercise programs for SUD patients need not be satisfied with engaging the better-off, or even those who are expected to maintain consistent interest or involvement. There were two differences between this program and previous interventions which may have enabled the engagement of the most vulnerable: this program included motivation-enhancing design

features, such as SMS reminders and motivational SMSes from coaches, and complementary attention was given to barriers to exercise that SUD patients have previously identified [16, 30] such as removing the need to travel and to purchase equipment, and monotony of exercises. As most design features were gleaned from best practices of exercise interventions among the overweight and elderly, their success prompts the SUD treatment field to borrow from exercise psychology in designing accessible programs.

4. Limitations and Conclusions

The observational nature and methodological limitations of this study mean that exercise cannot be isolated as the sole contributor to QoL increases. Such limitations included a small sample size and lack of a control group. Completers and non-completers differed at baseline according to their mental distress and somatic health burden and thus were not truly comparable in statistical terms. The impact of these differences, as well as of other unmeasured variables, may explain QoL improvements instead of exercise. However, while the ability to control for potential confounding variables was lost, this sampling method revealed the characteristics of the SUD patients to whom this exercise group appealed, namely, those with larger mental and physical health burdens. This provides useful information that can help future programs target those who liked this program, and adjust the program to appeal to a wider variety of patients. Given the feasibility of an exercise program as demonstrated by this study and the promising evidence of its QoL-boosting effects, such a program is worth replicating in a larger, experimental trial. This study provides promising evidence that low doses of group exercise can yield appreciable QoL benefits, even to SUD patients with more severe health problems.

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