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Short communication

Exercise-related activities are associated with positive outcome in contingency management treatment for substance use disorders

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ABSTRACT

Exercise has been proposed as an adjunct intervention for substance use disorders due to its many benefits in terms of mental and physical health. This study investigated the association between completion of exercise-related activities and substance use disorders treatment outcome in a sample of 187 participants undergoing intensive outpatient treatment with contingency management. The sample was divided into two groups based upon whether or not an individual completed an exercise-related activity. Individuals who engaged in exercise-related activities ($n=45$) were found to achieve longer durations of abstinence during treatment than individuals who did not complete an exercise-related activity ($n=142$). Overall, these findings suggest that exercise may be of benefit to individuals undergoing substance use disorders treatment. Methods for implementing an exercise intervention within substance use disorders treatment are discussed.

1. Introduction

Substance use can be conceptualized as a goal directed behavior governed by the principles of reinforcement. Animal studies show drug self-administration varies inversely with the availability of drug-free reinforcers such as food, wheel-running, and social environments (Ahmed, 2005). In humans, substance use often occurs at the expense of other, substance-free, activities including exercise (e.g., Van Etten, Higgins, Budney, & Badger, 1998). Therefore, the aim of this study is to investigate the relationship between completing exercise-related activities and substance use disorders (SUD) treatment outcome in an outpatient sample receiving contingency management (CM) treatments. CM interventions provided tangible reinforcers upon evidence of behavior change, such as submission of drug-free specimens or completion of substance-free activities.

Exercise improves cardiovascular health, decreases risks for various chronic medical diseases, and improves health-related quality of life (Penedo & Dahn, 2005). In addition, exercise has mental health benefits; exercise is consistently associated with positive mood by increasing feelings of vigor and reducing tension, fatigue, and confusion (Puetz, O'Connor, & Dishman, 2006). Exercise also reduces symptoms of depression and anxiety while lowering the risk of major depression relapse (Penedo & Dahn, 2005). These benefits are noteworthy, as affective disorders often co-occur with SUD.

Although studies investigating exercise as a component to SUD treatment are sparse and typically involve inpatient samples (e.g., Palmer, Vacc, & Epstein, 1988), these studies generally find improved physical fitness and decreases in depression and anxiety. More recently, Ussher and colleagues (2004) found that a single bout of exercise lessened urges to drink alcohol in alcohol detoxification patients. In a non-clinical setting, an exercise program significantly increased physical fitness and reduced alcohol consumption compared to a no-treatment control group in heavy drinking college students (Murphy, Pagano, & Marlatt, 1986). Together these studies suggest that exercise may be a beneficial component of SUD treatment.

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Table 1
Demographic characteristics by exercise group

Variable	Exercisers (n=45)		Non-exercisers (n=142)		Statistic (df)	p-value
	n	%	n	%		
Gender						
Male	24	53.3	55	38.7	$\chi^2(1)=2.99$	.084
Female	21	46.7	87	61.3		
Ethnicity						
Caucasian	17	37.8	28	19.7	$\chi^2(3)=11.57$	.009
African American	23	51.1	94	66.2		
Hispanic	2	4.4	18	12.7		
Other	3	6.7	2	1.4		
Marital status						
Single	21	46.7	88	62.0	$\chi^2(3)=5.09$	.166
Married/cohabitating	12	26.7	21	14.8		
Divorced/Separated	12	26.7	31	21.8		
Widowed	0	0.0	2	1.4		
Clinical trial						
Petry et al. (2004)	15	33.3	68	47.9	$\chi^2(1)=2.93$	.087
Petry et al. (2005)	30	66.7	74	52.1		
DSM-IV substance diagnosis						
Alcohol dependence	22	48.9	70	49.3	$\chi^2(1)=0.00$	.962
Cocaine dependence	39	86.7	122	85.9	$\chi^2(1)=0.02$	.899
Opioid dependence	9	30.0	27	36.5	$\chi^2(1)=0.40$	.529
Intake toxicology result						
Negative	38	84.4	103	73.0	$\chi^2(1)=2.42$	.120
	M	SD	M	SD		
Age (years)	36.0	6.2	35.4	7.2	$F(1,185)=0.31$	.579
Years of education	12.0	1.5	11.5	1.4	$F(1,185)=3.74$	.055
ASI composite scores						
Medical	0.13	0.3	0.22	0.3	$F(1,93)=3.84$	.053
Alcohol	0.20	0.2	0.19	0.2	$F(1,185)=0.15$	.698
Drug	0.15	0.1	0.17	0.1	$F(1,185)=1.24$	.268
Legal	0.12	0.2	0.13	0.2	$F(1,185)=0.02$	.902
Employment	0.62	0.3	0.79	0.3	$F(1,185)=11.04$	.001
Family/social	0.20	0.3	0.21	0.2	$F(1,185)=0.04$	.838
Psychiatric	0.28	0.2	0.23	0.2	$F(1,185)=1.43$	.233
Total number of activities completed	26.7	11.3	14.1	12.2	$F(1,185)=37.12$	.001

Note. Numbers do not always add up to group size due to missing data. ASI = Addiction Severity Index. Brown–Forsythe statistic reported for ASI medical composite score as variable violates assumptions of homogeneity. All analyses were conducted using SPSS 15.0®, and alpha was set at a p-value of less than 0.05.

We investigated the association between completion of exercise-related activities and treatment outcomes in a sample of SUD individuals undergoing CM treatment. The studies upon which we base our analyses were not designed as exercise initiation interventions; however, a proportion of participants in the trials engaged in exercise-related activities. Based upon the previous SUD and exercise literature, we hypothesize that individuals who engaged in exercise-related activities during CM treatment will have longer durations of abstinence in comparison to individuals who do not engage in exercise-related activities.

2. Methods

Data for this study were collected during two separate randomized clinical trials investigating the efficacy of CM in addition to standard intensive outpatient SUD treatment (Petry et al., 2004; Petry, Alessi, Marx, Austin, & Tardif, 2005). This study is limited to participants randomized to a CM treatment condition, as only the CM interventions in these studies required individuals to select, complete, and provide objective verification of goal-related activities (see Procedures section).

2.1. Participants and measures

Participants (N=187) were new admissions to intensive outpatient treatment for SUD (see Petry et al. (2004); Petry, Alessi, Marx, Austin, and Tardif, (2005) for additional eligibility criteria). All participants provided informed consent and the studies were approved by the university's Institutional Review Board.

Participants completed the Addiction Severity Index (ASI; McLellan et al., 1992), and modules of the Structured Clinical Interview for DSM-IV (First, Spitzer, Gibbon, & Williams, 1996) were administered to assess past-year SUD. Breath and urine samples were also collected and screened for alcohol using an Alco-sensor IV Alcometer (Intoximetrics, St. Louis, MO) and opioids and cocaine using OnTrak TesTstiks (Varian, Inc., Walnut Creek, CA). Participants submitted up to 21 breath and urine samples over the 12-week treatment period.

Table 2
Analysis of covariance of longest duration of abstinence (n=186)

Source of variance	*df*	Mean square	*F*	*p*-value
ASI employment composite score	1	12.33	2.63	.107
ASI medical composite score	1	1.31	0.28	.597
Number of activities completed	1	13388.06	296.44	>.001
Clinical trial	1	0.54	0.11	.736
Gender	1	3.60	0.77	.382
Ethnicity	3	10.68	2.28	.081
Baseline toxicology result	1	243.72	52.05	>.001
Exercise group	1	40.89	8.73	.004

Note. ASI=Addiction Severity Index.

2.2. Procedures

Participants completed a 2-hour baseline interview consisting of measures listed above.

2.2.1. CM treatment

In addition to intensive outpatient SUD treatment, CM treatment monitored the target behaviors frequently, and provided reinforcement (range=$80 to $882 in prizes or vouchers) for sustained completion of target behaviors. Failure to complete target behaviors led to withholding reinforcement and subsequent bonuses were returned to a low level. The two target behaviors reinforced in these studies were drug abstinence and completion of goal-related activities. Each behavior was reinforced independently.

Participants had to submit breath and urine samples that tested negative for alcohol, cocaine and opioids to earn reinforcement for drug abstinence. Completion of goal-related activities involved participants choosing three specific goal-related activities to complete each week. They received reinforcement for each completed and objectively verified (e.g., receipt, doctor's note) activity. A total of 36 activities were possible over the 12 weeks of treatment. (See Petry, Tedford, and Martin [2001] for a description of types of activities selected and verified.)

For purposes of this study, activities were coded as exercise-related or not. Self-selected exercise activities were broadly defined and could be indirect (e.g., buying sneakers, planning a workout routine) or direct (e.g., playing basketball, swimming, jogging). Activities were coded as non-exercise if they did not relate to the preparation of or engagement in physical activity (e.g., attending a NA meeting, attending a doctor's appointment, paying rent). Participants were encouraged to select activities based upon the results of a needs assessment.

2.3. Statistical analyses

Participants were classified as exercisers or non-exercisers on the basis of whether they selected and completed one or more exercise activities during the 12 weeks of CM treatment. Three raters independently reviewed all activities and coded whether they related to exercise or not. Interrater reliabilities were good (rs>0.8). When raters disagreed about the coding, the raters met, discussed the item, and came to agreement.

Differences between exercisers and non-exercisers on demographic and substance use variables were evaluated using Chi-squared tests and ANOVA. ANCOVA evaluated exercise group differences on longest duration of abstinence, measured in weeks. Variables that differed significantly between the exercisers and non-exercisers at baseline, and variables that are known to be associated with outcomes (e.g., intake toxicology result) were also included.

3. Results

Overall, 45 participants (24.1%) completed at least one exercise activity (i.e., exercisers) and 142 participants (75.9%) did not complete any exercise activities (i.e., non-exercisers). The mean number of exercise activities completed by exercisers was 1.78 (SD=1.62; range=1–7). Table 1 presents baseline demographic and clinical characteristics of the sample divided by exercise status (i.e., exercisers vs. non-exercisers). Ethnicity, total number of activities completed, and ASI employment composite score differed by group, $p<.05$.

Table 2 provides the results of the ANCOVA predicting treatment outcome. The covariates baseline toxicology result and total number of activities completed were significantly associated with longest duration of abstinence, $ps<.01$. The adjusted longest duration of abstinence in weeks was 6.83 (SE=0.31) for those with a negative baseline toxicology result and 3.96 (0.44) for those with a positive baseline toxicology result. Completing more activities overall was positively associated with longest duration of abstinence. Even after controlling for these variables, exercise status was associated with longest duration of abstinence, $p<.01$. The adjusted longest duration of abstinence in weeks was 6.04 (0.43) for exercisers and 4.75 (0.34) for non-exercisers.

4. Discussion

The relationship between completion of exercise-related activities and treatment outcome was assessed in 187 participants who received CM plus standard intensive outpatient SUD treatment. Almost 25% of participants completed at least one exercise-

related activity during the 12 weeks of CM treatment. Those who completed an exercise-related activity had significantly longer durations of abstinence compared to participants who did not complete any exercise-related activities, even after accounting for other relevant factors that may have influenced treatment outcome, such as baseline toxicology result. Therefore, participation in exercise may have a positive impact upon SUD treatment outcome.

While encouraging, these findings are preliminary. The study was associative, and individuals self selected activities. Further, participation in exercise was limited with few individuals completing more than two exercise-related activities. However, even one bout of exercise can temporarily reduce urges to use (Ussher et al., 2004). Overall, results suggest that exercise warrants further investigation as an adjunct treatment for SUD.

We propose that incorporating exercise into SUD treatment can be done via CM. Exercise programs can be structured such that the behavior is monitored and reinforced. For example, pedometers can be worn with specific criterion counts required to earn reinforcement. Exercise equipment can store and track individual workout records. Finally, attendance records at exercise classes, either at the clinic itself or offsite, can be monitored. In sum, completing exercise-related activities was associated with longer durations of abstinence in a sample of outpatient SUD individuals receiving CM treatment, and reinforcing exercise using CM procedures may assist in preventing relapse.

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