Effects of a Group Protocol on Physical Activity and Associated Changes in Mood and Health Locus of Control in Adults with Parkinson Disease and Reduced Mobility

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ABSTRACT

Background: Parkinson disease (PD) is a degenerative nervous disorder that affects motor functioning. Although physical activity is beneficial, it often is reduced, and psychosocial issues persist such as low mood and perceptions of loss of control over health.

Objective: To determine the extent to which a community-based physical activity/self-regulatory skills intervention affects overall physical activity and changes in psychosocial factors in adults with PD and in adults with reduced mobility without PD.

Methods: Existing participants (N = 45, mean age = 71 years) of community-based PD group movement classes, who also participated in an individualized 6-session protocol for exercise support that emphasized self-regulation through barriers, completed validated self-report surveys. Participants' mean length of movement class participation was 11.8 months at the time of survey administration.

Results: Mixed-model repeated-measures analysis of variance indicated significant improvements in physical activity, self-regulation, exercise self-efficacy, negative mood, and task social cohesion but not internal health locus of control. Improvement in social cohesion was significantly greater in the PD group (n = 27) than in the non-PD (n = 18) group. Changes in exercise self-efficacy mediated a significant relationship between changes in self-regulation and physical activity. Changes in social cohesion mediated a significant relationship between changes in physical activity and mood. Changes in mood and social cohesion had a reciprocal, mutually reinforcing relationship. For the PD group, length of program involvement predicted vigor change ($r = 0.52$, $p = 0.006$).

Conclusion: The intervention demonstrated positive effects on physical activity and psychosocial factors in adults with PD and with reduced mobility. Effects on social cohesion were important. Such programming should be considered as an adjunct to traditional medical treatment.

INTRODUCTION

Parkinson disease (PD) is a long-term degenerative disorder of the nervous system that adversely impacts physical movements.[1] PD typically affects adults over age 60 years,[1] with prevalence being somewhat higher in men than in women.[2] PD is associated with reduced mobility, balance, and strength along with bradykinesia and its concomitant manifestations of bodily tremors, weakness, and rigidity.[2] Other PD symptoms that negatively influence quality of life include negative mood, loss of energy, and a perceived loss of control over one's health (ie, internal health locus of control[3]).[4,5] Although physical activity helps to reduce PD's physical progression,[6,7] people with PD may limit their activities because they fear falling, discomfort, and social stigma.[8] Physical activity also improves overall mood in adults[9] even when there is a mood disorder such as major depression,[10] which occurs in as many as 40% of those with PD.[11] Because recommended minimum amounts of physical activity (ie, 150 min/wk of moderate activity[12]) are completed by only 2% of US adults ages 60 and older,[13] activity implementation might be particularly problematic for those with the additional burden of PD. The effects of physical activity on PD-related psychosocial factors have been understudied and remain unclear.[14]

A cognitive-behavioral treatment protocol, The Coach Approach, has been successfully tested for its effectiveness in supporting physical activity efforts in individuals with adherence difficulties[15-17] and in those with challenges such as severe obesity[18] and diabetes.[19] Consistent with its theoretical bases in social cognitive theory,[20] a major focus within the individually administered protocol is building self-regulatory skills such as relapse prevention and cognitive restructuring to counter common barriers such as exercise-induced discomfort, slow progress, and boredom. Research suggests that when newly learned self-regulatory skills are used to overcome a perceived or actual barrier, feelings of ability (ie, self-efficacy) escalate, which further promotes physical activity.[21,22] While using The Coach Approach, individuals are encouraged to participate in group exercise classes at an appropriate level to facilitate social support and further encourage adherence. On the basis of a review of previous research,[23] investigators posited that building feelings of social bonding and support around a particular task such as weight loss or disease management could also benefit mood and perceptions of behavior control and vice versa.

PD treatments primarily have targeted physical symptoms.[6] It was thought that if The Coach Approach was paired with a group physical activity class tailored for individuals with PD, overall physical activity and psychosocial factors would improve. As suggested in a 2009 publication,[24] the use of a community-based setting for such an investigation would allow for high generalizability of findings to "real-world" venues and provide

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data when relationships between physical activity and psychosocial factors could be evaluated. Such findings could simultaneously contribute to health behavior-change theory, allow for evaluation of intervention efficacy, and inform architectures for expansion of such interventions in the future. Although the present physical activity movement class was described as serving the needs of people with PD, it also was open to adults with limited mobility without PD. This approach enabled changes associated with the 2-component intervention to be compared across PD and non-PD groups.

The following hypotheses are given: 1) both groups would demonstrate significant improvements in overall physical activity, self-regulation, exercise self-efficacy, negative mood, task social cohesion, and internal health locus of control and that improvements in task social cohesion and internal health locus of control would be significantly greater in the PD group; 2) change in exercise self-efficacy would significantly mediate the significant prediction of change in physical activity by changes in self-regulation and that the relationship between changes in physical activity and self-efficacy would be reciprocal; and 3) change in task social cohesion would significantly mediate the significant prediction of change in negative mood and internal health locus of control by physical activity change (in separate analyses) and that relationships between changes in negative mood, internal health locus of control, and social cohesion would be reciprocal.

METHODS

Participants

Participants in a Southeastern US community-based PD movement class were asked to volunteer to complete surveys about psychosocial factors related to their class. Those who refused participation (9%) cited time demands, physical burdens related to sitting and writing, and concerns regarding anonymity. Because effects of the individually administered exercise support protocol, The Coach Approach,[17] were of interest, participants who were exposed to it for at least 3 sessions (over at least 2 months) were included. They were grouped into participants reporting a diagnosis of PD (PD group, n = 27) and participants with reduced mobility but without a PD diagnosis (non-PD group, n = 18). On a scale indicating PD symptom severity (0 = *none* to 5 = *high*), the PD group had a mean score of 2.8 (standard deviation [SD] = 1.0). There was no significant difference between these groups in proportion of men (42% overall); self-reported age (overall mean = 71.2 years, SD = 7.1); body mass index (overall mean = 27.2 kg/m^2, SD = 6.3); ethnicity (overall 86% white, 9% African American, 6% other); education (overall 53% college degree or higher); or annual family income (mostly in the $50,000-$100,000 range). At the time of survey administration, participants' mean length of movement class participation was 11.8 months (SD = 8.8), which did not significantly differ by group. Institutional review board approval and participant written informed consent were obtained.

Measures

Because this study's methodology required participants to complete the physical activity and psychosocial factor surveys twice during a single session,[25] an effort was made to keep the measures brief to reduce burden and promote accuracy.[26] Evidence of adequate reliability and validity within the measures was required; internal validity is reported as Cronbach's α, and test-retest reliability is reported in 2- to 4-week intervals.

Weekly physical activity was recalled by using the Leisure-Time Physical Activity Questionnaire.[27,28] Using the metric of metabolic equivalents of task (METs, a unit of energy expenditure in which 1 MET = 3.5 mL of O_2/kg/min[29]), respondents indicated how many physical activity sessions of at least 15 minutes' duration were completed, ranging from 3 METs (eg, "easy-paced walking") to 9 METs (eg, "running"). Responses were then summed for an overall total. For example, 2 sessions of 3 METs and 1 session of 9 METs would yield a total score of 15 METs. Predictive and concurrent validity of the Leisure-Time Physical Activity Questionnaire was demonstrated through its strong correspondences (p values < 0.001) with accelerometer scores and scores on maximal volume of oxygen-uptake treadmill tests.[30,31]

Self-regulation related to completing physical activity was measured with 10 items that reflected respondents' use of specific self-regulatory skills that were addressed by the physical activity support program and intended to counter common barriers. Items included "I set physical activity goals" and "I schedule my times to be physically active." Response options ranged from 1 (*never*) to 5 (*often*), with a possible score range of 10 to 50. With adults initiating a program of physical activity, internal consistency of the item set was 0.79, and test-retest reliability was 0.78.[32] Internal consistency among this study's participants was 0.90.

The Exercise Self-Efficacy Scale[33] was used to measure respondents' confidence in persisting with physical activity under 5 listed conditions (items) such as "When I am tired" and "When I am in a bad mood." Response options ranged from 1 (*not at all confident*) to 11 (*very confident*), with a possible score range of 5 to 55. Previous research indicated internal consistencies of 0.76 to 0.82 and a test-retest reliability of 0.90.[34] Internal consistency among the present study's participants was 0.93.

Task social cohesion was measured with the 5-item group integration task subscale of the Group Environment Questionnaire-Exercise Setting.[35] It measured respondents' perceptions of the group's "… task oriented similarity, closeness, and bonding…."[36p19] After making minor context modifications, items included, "Members of the class have similar aspirations and goals about our progress" and "If members of the class have a problem, everyone wants to help them when possible." Response options ranged from 1 (*strongly disagree*) to 9 (*strongly agree*), with a possible score range of 5 to 45. Previous research indicated internal consistencies of 0.71 to 0.77 and a test-retest reliability of 0.78.[35,37] Predictive validity was suggested because the scale significantly increased when a team-building intervention was applied in an exercise setting.[38] Internal consistency among the present study's participants was 0.86.

The internal health locus of control is a 6-item subscale of the Multidimensional

Health Locus of Control, Form C.[39] The subscale assesses expectancy of control over a respondent's personal health. Items include, "I am directly responsible for my health getting better or worse" and "The main thing which affects my health is what I myself do." Response options ranged from 1 (*strongly disagree*) to 6 (*strongly agree*), with a possible score range of 6 to 36. Previous analyses of 12 samples indicated a mean internal consistency of 0.67[40] and a test-retest reliability of 0.69.[41] Internal consistency among this study's participants was 0.81.

Negative mood was measured with the 30-item total mood disturbance scale of the Profile of Mood States-Brief,[42] which elicited respondents' feelings "over the past week." The aggregate measure of mood was derived by summing scores from the 5 items (each) related to depression/dejection (eg, "sad"), tension/anxiety (eg, "anxious"), fatigue/inertia (eg, "weary"), confusion/bewilderment (eg, "forgetful"), and anger/hostility (eg, "annoyed") and then subtracting scores from the vigor/activity items (eg, "energetic"). Response options ranged from 0 (*not at all*) to 4 (*extremely*), with a possible score range of -20 to 100. A lower score is more favorable. Previous research indicated an internal consistency range of 0.84 to 0.95 and test-retest reliability of 0.69.[42] Concurrent validity was indicated through strong correspondences with accepted scales that are lengthier and target specific dimensions of mood such as the Minnesota Multiphasic Personality Inventory and Beck Depression Inventory.[42] Internal consistency among this study's participants ranged between 0.82 and 0.94.

The Intervention Procedure

Participants were enrollees of 2 treatment components within a community health-promotion facility in the southeastern US. Instructors were existing staff members of community-based health promotion facilities and trained and certified in the treatment elements. The exercise support component consisted of The Coach Approach protocol,[17] which has been associated with increased physical activity outputs across a range of ages and physical conditions.[15-17,19] Within its six 45- to 60-minute sessions administered in a one-on-one format during approximately 26 weeks, participants discussed and rehearsed the following self-regulatory methods with a trained exercise leader: 1) long- and short-term goal setting, 2) obtaining performance feedback, 3) barrier identification, 4) behavioral contracting, 5) self-reward, 6) stress management, 7) productive self-talk/cognitive restructuring, 8) relapse prevention/preparing for setbacks, 9) identification of prompts/cues for successes and failures, and 10) recruiting social supports. A dedicated computer application supported all protocol processes. The Coach Approach protocol and its computer support has the flexibility to enable an instructor to support PD-specific goals and document minor goal-based improvements that can be particularly challenging to achieve with a serious medical disorder. At the time of data collection, participants had either completed The Coach Approach or were at a stage beyond the third appointment (more than 2 months after starting).

The 45-minute PD movement class component was offered either 2 or 3 times per week at each of the 7 facilities involved in this research. One instructor who was certified by the American Council of Exercise to instruct those with PD[43] led each group exercise session, and an assistant helped participants, each of whom was positioned near a chair on the exercise floor. Chair use varied among participants functioning at different levels, but some activities were intended to be completed while seated. Each instructor had flexibility to apply a variety of tailored movements focused on strength (eg, standing or seated boxing movements, chair squats, wall push-up) and cardiovascular fitness (eg, forward walking with arm swing, use of aerobic step apparatus) while remaining within suggested parameters intended for participants with PD, restricted mobility, and fall-related concerns. Light hand weights, resistance bands, and exercise balls of various sizes also were incorporated. Effort levels were low/moderate during the five-minute warm-ups and cool-downs and moderate/intense for other cardiovascular and resistance activities. Background music usually was integrated, and class sizes averaged approximately 10 participants (range 7 to 15). The instructor engaged in supportive conversations with participants before and after class. Considerable unstructured interaction also was observed among participants.

Surveys were administered after a class under the supervision of study staff. Collaboration was not allowed while surveys were completed.

Data Analyses

On the basis of the planned regression analyses incorporating 2 predictors, an overall sample size of 42 was required to detect an effect of $f^2 = 0.25$ (estimated from previous research with similar measures, interventions, and demographics[32]) at the 0.80 power level ($\alpha = 0.05$).[44] After confirming that data were missing at random on the basis of suggested criteria,[45] the expectation-maximization algorithm[46] was incorporated to impute data for the 5% of missing cases. The minimal missing data partially were attributed to use of retrospective pretest methodology, which has been adequately validated and explained elsewhere.[25] In brief, this methodology requires respondents to complete 2 sets of surveys at a single session; the first set involves reflecting on the present (designated here as "time 2"). Immediately afterward, the participant must recall when s/he initiated participation (designated here as "time 1"). In addition to minimizing data lost to follow-up, research indicates this method protects against frequently inflated responses at baseline within the typical pre-/posttest format.[25] Gain (change) scores were the differences between time 1 and time 2. Because there were no problems with ceiling or floor effects, scores were unadjusted for their baseline value.[47] Statistical significance was set at $\alpha < 0.05$, with the Bonferroni correction applied to control for type 1 errors. SPSS Statistics Version 22 (IBM, Armonk, NY) was used for statistical computations incorporating the PROCESS macroinstruction (Model 4)[48] for mediation analyses.

A series of repeated-measures mixed-model analysis of variances was used first to assess significance of overall changes in physical activity, self-regulation,

exercise self-efficacy, negative mood, task social cohesion, and internal health locus of control between time 1 and time 2 and then to assess group × time interactions to determine if changes significantly differed by group. Corresponding effect sizes were represented as partial η^2 ($\eta^2_p = SS_{effect}/[SS_{effect} + SS_{error}$; 0.02 = small effect, 0.26 = large effect).

Data were then aggregated to assess whether change in exercise self-efficacy significantly mediated the prediction of change in physical activity by self-regulation change. A bias-corrected and accelerated bootstrapping method for mediation analyses with 20,000 resamples of the data was used.[49] Beta (β) values for path c (predictor → outcome or total effect), path a (predictor → mediators), path b (mediators → outcome), and path c′ (predictor → outcome while controlling for the mediator) were calculated. Significance of mediation occurs when 0 is not found between the lower and upper limits of the 95% confidence interval (95% CI) around the path a × path b coefficient (ie, indirect effect). Group membership originally was entered as a covariate to assess its effect on the models. To determine if changes in physical activity and exercise self-efficacy had a reciprocal (mutually reinforcing) relationship, their positions in the above-described mediation model were reversed. If the indirect effect was significant in both of the parallel equations, then a reciprocal relationship was detected.[50]

To assess whether change in task social cohesion significantly mediated the prediction of changes in negative mood and internal health locus of control by physical activity change, separate models were fit and the indirect effect was calculated as described here. Reciprocity of relationships between changes in negative mood and social cohesion and changes in internal health locus of control and social cohesion were tested.

RESULTS

Score Changes by Group

Independent *t*-tests indicated no significant baseline difference between the PD and non-PD groups on any of the variables of interest. Within the series of repeated-measures mixed-model analysis of variances, significant overall effects for time were found for improvements in self-regulation, exercise self-efficacy, negative mood, task social cohesion, and physical activity (Table 1). The increase in internal health locus of control did not reach statistical significance. Attainment of the minimum US government recommendation of physical activity for adults (ie, 25 METs on the basis of the presently used measure[27,28]) was 44% for the overall sample at time 1 vs 56% at time 2. There was a significant time × group interaction on only task social cohesion ($F(1, 43) = 5.46$, $p = 0.024$, $\eta^2_p = 0.11$), whereas the score increase in the PD group (mean change = 5.93, SD = 8.38) was significantly greater than in the non-PD group (mean change = 1.67, SD = 2.63).

Regression Analyses

Using aggregated data, intercorrelations of change scores were calculated (Table 2). There was minimal shared variance between the planned outcome measures of change in negative mood and internal health locus of control (< 1%), which justified separate analyses. Participant length of treatment was not significantly associated with score changes within the planned multiple regression analyses, nor did it significantly differ by group. Entry of group as a covariate did not significantly affect relationships within the below-multiple-regression equations ($p < 0.30$), so it subsequently was removed.

Psychosocial Predictors of Physical Activity Change

Within a linear bivariate analysis, change in physical activity was significantly predicted by change in self-regulation (Figure 1, left side, path c). That relationship was, however, no longer significant after change in exercise self-efficacy was entered into that model as the possible mediator (Figure 1, left side, path c′). Significant mediation was found (β = 0.52, standard error [SE] = 0.24, 95% CI = 0.087-1.064). The overall model was significant ($R^2 = 0.30$, $F(2, 42) = 8.86$, $p < 0.001$). In the corresponding equation (Figure 1, right side), physical activity

Table 1. Changes in study variables (N = 45)[a]

	Time 1		Time 2		Change, time 1 to time 2		Analysis of variance		
Variable	Mean	SD	Mean	SD	Mean	SD	F(1,43)	p value	η^2_p
Self-regulation	28.09	8.12	31.71	5.00	3.62	7.25	9.59	0.003	0.18
Exercise self-efficacy	30.49	12.17	36.00	13.04	5.51	9.58	12.92	0.001	0.23
Physical activity	26.44	21.13	32.01	24.42	5.57	16.03	4.76	0.035	0.10
Task social cohesion	35.29	9.87	39.29	6.40	4.00	7.11	11.65	0.001	0.21
Internal health locus of control	25.11	6.49	26.18	6.71	1.07	4.22	2.56	0.117	0.06
Negative mood	8.27	16.45	4.18	13.87	-4.09	11.82	5.02	0.030	0.11

[a] Data are based on scores aggregated across groups within a mixed-model repeated-measures analysis of variance (for time).
η^2_p = partial η^2 (0.02 = small effect to 0.26 = large effect); SD = standard deviation.

Table 2. Intercorrelations among change scores across study variables (N = 45)

Variables	1	2	3	4	5	6
1. ΔSelf-regulation	—	0.59[a]	0.44[a]	0.28	-0.10	-0.42[a]
2. ΔExercise self-efficacy	—	—	0.52[a]	0.09	0.19	-0.15
3. ΔPhysical activity	—	—	—	0.18	0.11	-0.40[a]
4. ΔTask social cohesion	—	—	—	—	0.19	-0.42[a]
5. ΔInternal health locus of control	—	—	—	—	—	-0.09
6. ΔNegative mood	—	—	—	—	—	—

[a] Bonferroni-corrected statistical significance was $p < 0.008$ (0.05/6 analyses).
Δ = change score from time 1 to time 2.

change was a significant mediator in the prediction of exercise self-efficacy change by change in self-regulation (β = 0.19, SE = 0.09, 95% CI = 0.037-0.399). Thus, a reciprocal positive relationship between changes in physical activity and exercise self-efficacy was identified.

Effects of Physical Activity on Mood and Health Locus of Control

Within a bivariate analysis, change in negative mood was significantly predicted by physical activity change (Figure 2, left side, path c). That relationship was weakened but remained significant when change in task social cohesion was entered into the model as the possible mediator (Figure 2, left side, path c′). Significant mediation was present (β = -0.05, SE = 0.03, 95% CI = -0.003 to 0.131). The overall model was significant (R^2 = 0.29, $F(2, 42)$ = 8.44, p < 0.001). In the corresponding equation (Figure 2, right side), negative mood change was found to be a significant mediator in the prediction of task social cohesion change by change in physical activity (β = 0.08, SE = 0.04, 95% CI = 0.019-0.184). Thus, a reciprocal inverse relationship between changes in task negative mood and task social cohesion was found.

Change in internal health locus of control was not significantly predicted by physical activity change (Figure 3, left side, path c). When entered into the model, task social cohesion was not a significant mediator (β = 0.01, SE = 0.01, 95% CI = -0.002 to 0.036). The overall model was not significant (R^2 = 0.04, $F(2, 42)$ = 0.93, p = 0.404). There was no reciprocal relationship between change in internal health locus of control and task social cohesion (Figure 3, right side).

In post hoc analyses of the outcome measures within the PD group at baseline, negative mood was significantly higher (mean = 11.19, SD = 16.48) than the normative score of similar-age adults (mean = 2.50,[42] $t(26)$ = 2.74, p = 0.011, 95% CI = 2.17-15.21). However, internal health locus of control in the PD group (mean = 23.48, SD = 6.42) did not significantly differ from the normative score of adults (mean = 22.72,[51] $t(26)$ = 0.62, p = 0.544, 95% CI = -1.78 to 3.30. Additionally, length of participation in the physical activity class (mean = 12.8 months, SD = 9.2) was significantly associated with vigor/inertia score change (r = 0.52, p = 0.006). Within the PD group, reported symptom severity was not significantly associated with change in weekly physical activity (r = 0.12, p < 0.55) or any assessed psychosocial variable (p values < 0.09).

DISCUSSION

The intervention, consisting of a cognitive-behavioral physical activity support that emphasized building an array of self-regulatory skills[17] and a physical activity class tailored for adults with varied severities of PD symptoms, was associated with increased overall physical activity and a variety of positive psychosocial

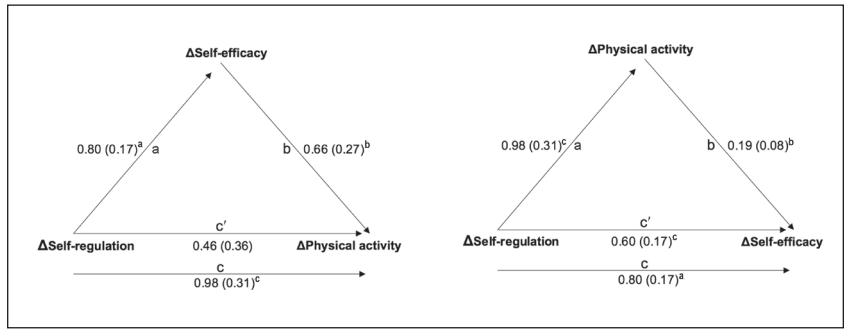

Figure 1. Mediation and reciprocal analyses in the prediction of change in physical activity.
[a] p < 0.001.
[b] p < 0.05.
[c] p < 0.01.
Δ = change in score from time 1 to time 2.

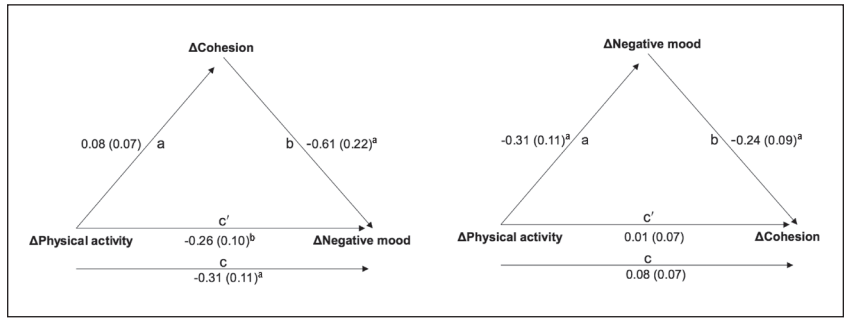

Figure 2. Mediation and reciprocal analyses in the prediction of change in negative mood.
[a] p < 0.01.
[b] p < 0.05.
Δ = change in score from time 1 to time 2.

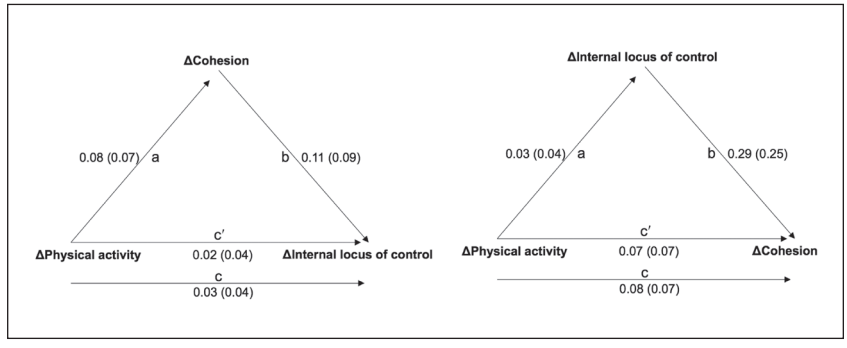

Figure 3. Mediation and reciprocal analyses in the prediction of change in internal health locus of control.
Δ = change in score from time 1 to time 2.

changes. Effects of social cohesion related to the task of maintaining physical activity and control of PD symptoms were, as expected, more pronounced among participants with PD. This validates the treatment's effectiveness in this area within the targeted population. In support of both theory and previous research,[20-22] the increased physical activity induced by heightened use of self-regulatory skills occurred largely through impacts on exercise-related self-efficacy (evidenced by changes in self-efficacy being significant mediators of the self-regulation-physical activity relationship). This suggests that when participants overcome barriers attributable to their directed use of self-regulation, productive feelings of ability and mastery (ie, self-efficacy) ensue. Also, findings indicated that under the present conditions, improvements in physical activity and self-efficacy form a reciprocal, mutually reinforcing cycle. Although the goal-setting and progress feedback segments of The Coach Approach promote this scenario within its one-on-one sessions,[17] enhanced efforts should be made to transfer these processes to class instructors for the benefit of their participants. Because of the deteriorating nature of PD,[1] emphases on even small successes can be extremely productive to help ensure that future physical activity behaviors do not diminish over time.

Also, as expected, increased physical activity predicted improved mood. This is important because of the preponderance of mood problems associated with PD,[11] which was demonstrated in the present sample when scores were contrasted with normative values. Physical activity-induced mood change is consistent in most research across adult populations[9] but has been understudied in PD samples.[52] Some research failed to detect significant exercise-associated mood improvements in those with PD.[53,54] The significant mood improvements observed in this sample occurred even though participants reported considerably more physical activity at program start than older adults in the general public.[13] When the equivalent of 3 sessions of moderate physical activity per week is attained (approximately 15 METs using the present measure[27,28]), further mood improvements typically are not observed.[18] A partial explanation for the progress realized here could be via its association with increased task cohesion—a variable not well accounted for in previous studies. For example, a single 10-week study using a social dance intervention observed a significant improvement in overall negative mood,[55] which supports the proposed effects of socialization on mood change. Although links between social support and mood previously have been suggested within theory and research,[23,56] the present association suggests a point for emphasis within future physical activity interventions serving those with PD. Although productive social dynamics have occurred spontaneously in groups of adult exercisers,[57] ways to enhance cohesion related to common goals within a structured physical activity class should be explored in extensions of this research.

Although the outcome measure of health locus of control appeared to trend toward improvement in this relatively small sample, it did not reach statistical significance as was expected. Further research is needed to address this construct within the PD population, for whom perceptions of control are challenged over time as physical degeneration occurs. Positive effects on energy and mood, as evidenced through the course of a seemingly empowering treatment such as the one described here, may be promoted to participants as providing an improved degree of control over their holistic health.

The field nature of this research resulted in limited control over factors such as participants' out-of-class support, instructor effects, and the relative impacts of the 2 treatment components. Yet, these potential confounding factors are countered by an ability to generalize findings to applied settings in which the need is great.[24] Although social cognitive theory[20,22] guided the physical activity support component, its constructs were not comprehensively addressed, which might be foci for extensions of this investigation. Other limitations of this research included different lengths of exposure to the intervention, samples that were mostly white and middle class, and the inclusion of only a self-selected group of individuals who might have been atypically motivated to persevere through physical challenges. This was exemplified by physical activity levels at time 1 being vastly different than typically encountered in the overall population of similar-age adults.[13] Some of these concerns should be addressed through the use of a control group in future replications. Also, degrees of PD symptom severity might be more effectively assessed with statistical controls.

Even when considering these issues, this study substantially extended the extant research on physical activity and PD, which primarily has focused on physiologic symptoms.[53] As previously suggested,[58] the incorporation of psychosocial mediators into the analyses helped expand the applicability of these findings.

CONCLUSION

This intervention demonstrated promise for improving psychological factors and feelings of social connectedness in the PD population. A community-based venue and existing instructors enabled efficient dissemination of the intervention; these methods can be expanded to help many in need.[59] Treating ancillary symptoms of PD such as mood disorders and depression in an economically sound manner while simultaneously engaging individuals in productive physical exercise may be increasingly possible through methods such as those tested here. If similar protocols can be improved, further standardized, and appropriately evaluated for efficacy, medical professionals will have more opportunities and confidence when referring patients to them as important adjuncts to traditional medical interventions. ❖

Disclosure Statement

The author(s) have no conflicts of interest to disclose.

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