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The effect of a community-based Argentine tango dance program on activity participation among individuals with Parkinson disease

Abstract

Objective: To determine the effect of a 12-month community-based tango dance program on activity participation among individuals with Parkinson disease (PD).

Design: Randomized controlled trial with assessment at baseline, 3, 6, and 12 months.

Setting: The intervention was administered in the community; assessments were completed in a university laboratory.

Participants: Sixty-two volunteers with PD enrolled in the study and were randomized to treatment group. Ten participants did not receive the allocated intervention, so the final analyzed sample included 52 participants.

Intervention: Participants were randomly assigned to the Tango group, which involved 12 months of twice weekly Argentine tango dance classes, or to the no intervention Control group (n = 26 per group).

Main Outcome Measures: Current, new and retained participation in instrumental, leisure and social activities as measured by the Activity Card Sort (with the “dance” activity removed).

Results: Total Current participation in the Tango group was higher at 3, 6, and 12 months compared to baseline ($ps \leq 0.008$), while the Control group did not change ($ps \geq 0.11$). Total Activity Retention (since onset of PD) in the Tango group increased from 77% to 90% ($p = 0.006$) over the course of the study, whereas the Control group remained around 80% ($p = 0.60$). These patterns were similar in the separate activity domains. The Tango group gained a significant number of New Social activities ($p = 0.003$), but the Control group did not ($p = 0.71$).

Conclusions: Individuals with PD who participated in a community-based Argentine tango class reported increased participation in complex daily activities, recovery of activities lost since the

onset of PD, and engagement in new activities. Incorporating dance into the clinical management of PD may benefit participation and subsequently quality of life for this population.

Keywords: Parkinson disease; exercise; rehabilitation; social participation; quality of life

Abbreviations: ADL = Activities of daily living; ACS = Activity Card Sort; PD = Parkinson disease; UPDRS = Unified Parkinson's Disease Rating Scale

1 Parkinson disease (PD) is a neurodegenerative disorder that affects over one million North
2 Americans ¹. In PD, degeneration of dopamine-producing neurons in the substantia nigra disrupts
3 basal ganglia functioning. This results in motor dysfunction, most prominently tremor, rigidity,
4 akinesia, bradykinesia, and postural instability. In addition, individuals with PD can experience a
5 variety of non-motor problems such as sensory disturbances, cognitive impairment, autonomic
6 dysfunction, and psychological changes ^{2,3}. As PD progresses, it can hinder the individual's
7 ability to perform activities of daily living (ADL), leading to dependency on others ^{4,5}. As such,
8 PD is associated with reduced quality of life ⁶⁻⁸ and significant socioeconomic costs ⁹.

9
10 Although loss of independence in ADL (i.e., disability) is thought to occur in the middle or
11 moderate stages of disease progression ⁴, emerging research ¹⁰ suggests that PD can negatively
12 impact participation early in the disease. The International Classification of Functioning,
13 Disability and Health (ICF) defines participation as involvement in life situations and the extent
14 to which individuals are engaged in a societal context ¹¹. Individuals with early and mild PD, for
15 whom motor dysfunction is not yet sufficient to cause physical disability, report reduced
16 participation in instrumental, low physical-demand leisure and social activities compared to
17 healthy, age-matched peers ^{10,12}. Furthermore, participation restrictions among individuals with
18 PD are associated with reduced health-related quality of life ^{12,13}. Participation is positively
19 correlated with functional status and life satisfaction ^{14,15} and may be protective against physical
20 and cognitive decline as people age ^{16,17}. These links highlight the importance of pursuing
21 interventions targeted at improving participation for those with PD. Dopaminergic medication
22 does not adequately address many of the factors which contribute to reduced participation in this
23 population including impaired mobility, depressive symptoms, and cognitive dysfunction ^{10,13,18}.

24 There is a need for more comprehensive approaches to manage the complex manifestations of
25 PD and their effects on individuals' participation.

26

27 One adjunct to medical treatment that is beneficial for PD patients is exercise. Exercise has been
28 found to improve physical function, mobility, cognition, and health-related quality of life among
29 individuals with PD ¹⁹⁻²¹. Unfortunately, more than half of all American seniors do not engage in
30 the recommended amount of exercise, and those with PD engage in 15% less exercise than their
31 healthy peers ²². Because of this, the identification of alternative forms of exercise that are at
32 least as effective as traditional exercise programs but foster better adherence are needed.

33 Individuals with PD report that social support and social interaction positively influence their
34 exercise adherence, with one of the most salient motivators being spousal participation ^{23, 24}.

35 Dance is a form of partnered exercise that provides social engagement and, importantly, has been
36 found to have a higher adherence rate than other forms of exercise among individuals with PD ²⁵.

37 At the end of a study comparing traditional exercise to dance ²⁶, nearly half of the participants in
38 the dance group chose to continue to participate in the dance classes while no participants from
39 the traditional exercise class continued their form of exercise. Instead, some of the participants
40 from the traditional exercise group chose to attend the dance classes after the study was
41 complete.

42

43 In addition to promoting better adherence, dance may improve upon the beneficial physical
44 effects of traditional exercise. In the study described above ²⁵, the dance group showed
45 significant improvements in balance, whereas the traditional exercise group did not. Argentine
46 tango was found to be a particularly effective form of dance, resulting in larger improvements in

47 balance, mobility, movement initiation, and attention to movement control compared to other
48 forms of dance (waltz and foxtrot) ²⁷. The positive effects of Argentine tango on physical
49 function (e.g., motor dysfunction severity, balance, gait) and progression of motor symptoms
50 were recently confirmed in a randomized controlled trial of a long-term community-based tango
51 dancing program ²⁸.

52

53 The benefits of tango dancing may extend beyond physical improvements to stimulate broader
54 participation in life activities and roles for those with PD ²⁹. For example, partnered exercise
55 programs can facilitate the development of social support networks, thereby increasing
56 opportunities for social participation outside of the formal program ²³. Interventions for
57 improving participation among individuals with PD have previously been unexplored. The
58 purpose of this study was to determine whether the community-based tango dance program that
59 reduced disease severity and improved physical function in a group of PD patients ²⁸ affected
60 activity participation. We hypothesized that PD participants who engaged in the dance program
61 would report increased activity participation over the course of the study relative to a control
62 group of participants with PD who did not engage in the dance program.

63

64 **METHODS**

65

66 **Participants**

67

68 Participants were recruited from the clinical research database of the Washington University
69 School of Medicine (WUSM) Movement Disorders Center, the WUSM Research Participant

70 Registry, neurologists in the St. Louis area, and advertisements in the newsletter of the Greater
71 St. Louis Chapter American Parkinson Disease Association. All participants were diagnosed
72 with idiopathic PD using published clinical diagnostic criteria ³⁰, were classified as Hoehn and
73 Yahr stages I–IV ³¹, and experienced clear motor benefit from levodopa. Participants had to be
74 able to walk independently for 10 feet with or without an assistive device. Individuals were
75 excluded if they had a history of neurological deficit other than PD, serious medical problem(s),
76 evidence of abnormality other than PD-related changes on brain imaging, or history or evidence
77 of musculoskeletal or psychological problems. This study was approved by the institution’s
78 Human Research Protection Office, and all participants provided written informed consent.

79

80 **Intervention**

81

82 This was a single-blind randomized controlled trial. Upon enrollment, participants were
83 randomly assigned to the Tango or Control group. The protocol for the tango intervention was
84 based on prior investigations of the effects of Argentine tango for individuals with PD ³². Tango
85 participants attended one-hour dance classes two times per week for 12 months. Dance classes
86 were taught by an experienced dance instructor who was trained and supervised by the principal
87 investigator (G.E.) to ensure appropriateness and safety for individuals with PD. The classes
88 consisted of progressive Argentine tango lessons in which participants learned a new step in each
89 class. This form of dance involved flexible, improvisational step patterns composed of small step
90 elements, spontaneous multi-directional changes, and rhythmic variation. Individuals with PD
91 were paired with individuals who did not have PD. These dance partners were caregivers (e.g.,
92 spouses, family members) who accompanied PD participants to the classes and healthy young

93 volunteers recruited from health-related graduate and undergraduate departments at Washington
94 University in St. Louis (volunteers received special training on fall prevention and safety). All
95 individuals, regardless of gender, were asked to dance in both the leader and follower roles to
96 ensure that everyone spent similar amounts of time moving forward and backward. In addition,
97 participants changed partners every ten minutes, a practice commonly used in dance classes to
98 facilitate learning. Control participants were asked to continue the normal life routine that they
99 had engaged in before enrolling in the study.

100

101 **Assessment Procedure**

102

103 Control and Tango participants were evaluated at baseline and then at 3, 6, and 12 months post-
104 baseline. All assessments were conducted while participants were off their regular anti-
105 parkinsonian medications (12 hour washout period) by a blinded rater (R.D.) at the WUSM
106 Program in Physical Therapy. The full evaluation consisted of a variety of measures to
107 characterize physical function and mobility, including the Unified Parkinson's Disease Rating
108 Scale sections 1-3³³ (for a complete description of study measures, see²⁸). The Beck Depression
109 Inventory-II^{34,35} was administered to assess depressive symptoms. Participation, the primary
110 outcome for this analysis, was measured using the Activity Card Sort (ACS)³⁶. The ACS is a
111 standardized assessment that measures perceived level of participation in daily life activities as
112 well as changes in participation in relation to certain events (e.g., the onset of disease or
113 disability, beginning a new treatment regimen) or over specified periods of time (e.g., in the past
114 five years). It consists of 89 cards containing pictures of people involved in activities that fall
115 into one of four domains: (1) Instrumental activities (20 items; e.g. grocery shopping, doing

116 laundry, household maintenance), (2) Low-demand Leisure activities (35 items; e.g. cooking as a
117 hobby, playing table games, reading, watching movies or television), (3) High-demand Leisure
118 activities (17 items; e.g. swimming, woodworking, hiking, fishing, gardening), and (4) Social
119 activities (17 items; e.g. traveling, eating at a restaurant, volunteer work, spending time with
120 friends). Participants sorted the cards into one of five categories with the corresponding
121 numerical point values: *Continue to Do since Illness [at pre-illness level]* = 1, *Do Less since*
122 *Illness* = 0.5, *Given Up Due to Illness* = 0, *New Activity since Illness* = 1, or *Not Done Prior to*
123 *Illness* = 0. Parkinson disease was the “Illness” to which the categories referred. As per
124 published scoring criteria³⁶, Current participation scores were calculated by summing the point
125 values for the activities sorted into the *Continue to Do*, *Do Less*, and *New Activity* categories.
126 Activities sorted into the *Continue to Do*, *Do Less*, and *Given Up* categories each also received 1
127 point for Previous participation. Activity Retention since PD Onset was calculated by dividing
128 Current by Previous participation scores. These calculations were completed for all activities
129 (Total) and for the separate activity domains (Instrumental, Low-demand Leisure, High-demand
130 Leisure, Social). The ACS includes “dancing” as a social activity; however, this item was
131 removed from analysis so it would not inflate the Tango participants’ scores. In the present
132 study, Total Current and Previous scores could range from 0 to 88, and separate activity domain
133 score ranges are as follows: Instrumental: 0-20, Low-demand Leisure: 0-35, High-demand
134 Leisure: 0-17, Social: 0-16. Higher scores indicate participation in more activities. Activity
135 Retention scores could range from 0% to 100%, with higher scores indicating proportionately
136 more activities retained since the onset of PD. The ACS has strong psychometric properties,
137 including good internal consistency (0.61-0.82)³⁷, test-retest reliability (0.90)³⁸, and concurrent
138 and predictive validity³⁷.

139

140 **Statistical Analyses**

141

142 Descriptive statistics were calculated for all variables. Group characteristics at baseline were
143 compared using independent samples t-tests, Wilcoxon signed rank tests for ordinal scales (e.g.,
144 Hoehn and Yahr stage), and Chi-squared tests for categorical data (e.g., gender). Longitudinal
145 analyses were conducted using mixed-model 2x4 analyses of variance with group (Tango,
146 Control) as the between-subjects factor and time (baseline, 3, 6, and 12 months) as the within-
147 subjects factor. Planned pairwise comparisons were used to characterize change over time within
148 each group. An intent-to-treat analysis was employed including all participants who completed
149 the baseline and 3-month evaluation and carrying forward last recorded data for those who
150 dropped out after this point. A significance level of 0.05 was used in all statistical analyses, and
151 p-values < 0.10 were considered trends.

152

153 **RESULTS**

154

155 **Participant characteristics**

156

157 Sixty-two individuals with idiopathic PD (30 Control, 32 Tango) enrolled in this study, were
158 randomized to treatment group and completed the baseline evaluation. Fifty-two participants (26
159 Control, 26 Tango) completed the 3-month evaluation and were included in the current analysis
160 (Figure 1). Sample characteristics are presented in Table 1. There were no differences between

161 the Tango and Control groups at baseline with regards to gender, age, duration and severity of
162 PD, or depressive symptoms (all $p \geq 0.25$)

163

164 **Activity Participation**

165

166 *Current Participation.* There were no group differences in Current participation at baseline for
167 Total activities or for the separate activity domains (all $p \geq 0.15$). There was an effect of time,
168 $F(3, 48) = 2.78, p = 0.04$, and a trend for a time by group interaction in Total Current
169 participation, $F(3, 48) = 2.55, p = 0.06$ (Figure 2). Planned comparisons indicated that there was
170 a main effect of time in the Tango group, $F(3, 48) = 4.05, p = 0.01$, but not the Control group,
171 $F(3, 48) = 0.96, p = 0.42$. Specifically, the Total Current participation of the Tango group was
172 higher at 3, 6, and 12 months compared to baseline (all $p \leq 0.008$), while the Control group did
173 not change (all $p \geq 0.11$). Analysis of the separate activity domains (Figure 3) showed a similar
174 pattern for Low-demand Leisure activities, such that there was a main effect of time for the
175 Tango group, $F(3, 48) = 4.75, p = 0.006$, but not for the Control group, $F(3, 48) = 1.36, p = 0.27$.
176 Low-demand Leisure participation was higher in the Tango group at 3, 6, and 12 months
177 compared to baseline (all $p \leq 0.03$), while the Control group did not change (all $p \geq 0.50$). There
178 were no significant effects for High-demand Leisure, Instrumental or Social activities (all $p \geq$
179 0.11).

180

181 *Activity Retention since PD Onset.* There was a main effect of time for Total Activity Retention,
182 $F(3, 48) = 3.70, p = 0.02$. The time by group interaction did not reach significance ($p = 0.15$);
183 however, as with Total Current Participation, planned comparisons revealed a significant effect

184 of time within the Tango group, $F(3, 48) = 4.68, p = 0.006$, but not the Control group, $F(3, 48) =$
185 $0.631, p = 0.60$ (Figure 4). Over the course of the study, the percentage of pre-PD activities
186 engaged in by the Tango group increased from 77% to 90%, whereas the Control group remained
187 around 80%. Analysis of the separate activity domains (Figure 5) revealed significant effects of
188 time on Instrumental and Low-demand Leisure Activity Retention in the Tango group, $F_s \geq 3.7,$
189 $p_s \leq 0.02$, but not the Control group, $F_s < 0.47, p \geq 0.70$. Percentage of pre-PD Instrumental
190 activities increased from 76% at baseline to 87% at 3 months before declining to 81% at 12
191 months in the Tango group but remained around 80% in the Control group. Percentage of pre-PD
192 Low-demand Leisure activities increased from 79% to 106% in the Tango group but remained at
193 84% in the Control group. This indicates that the Tango participants reported engaging in *more*
194 Low-demand Leisure activities at the end of the study compared to before the onset of PD. There
195 was an effect of time for Social Activity Retention, $F(1, 50) = 13.75, p = 0.001$. Percentage of
196 pre-PD Social activities in the Tango group increased from 85% at baseline to 94% and 102% at
197 3 and 6 months, respectively, before declining to 89% at 12 months, $F(3, 48) = 4.83, p = 0.005$.
198 After an initial increase from 85% at baseline to 90% at 3 months in the Control group, there was
199 a decline to 82% at 12 months, $F(3, 48) = 2.61, p = 0.06$. There were no significant effects for
200 High-demand Leisure Activity Retention (all $p \geq 0.25$).

201
202 *New Activities.* There was a main effect of time on New Activity participation, $F(3, 48) = 9.83, p$
203 < 0.001 , such that both groups reported more new activities at 3, 6, and 12 months compared to
204 baseline (all $p \leq 0.001$) (Figure 6). On average, the Tango group reported 2.6 ($SD = 3.9$) new
205 activities at each time point and the Control group reported 1.4 ($SD = 3.6$). The effect of time
206 was significant for each activity domain, $F_s \geq 5.46, p_s < 0.01$ (Figure 7). However, for New

207 Social activities, it was qualified by a time by group interaction, $F(3, 48) = 4.26, p = 0.03$, such
208 that there was a significant effect of time in the Tango group, $F(3, 48) = 5.38, p = 0.003$, but not
209 the Control group, $F(3, 48) = 0.47, p = 0.71$. The Tango group gained a significant number of
210 new Social activities from baseline to 3, 6, and 12 months ($M = 0.5, SD = 1.1; ps < 0.001$) but the
211 Control group did not ($M = 0.15, SD = 0.48; ps \geq 0.31$).

212

213 **DISCUSSION**

214

215 The purpose of this study was to examine the effects of a community-based Argentine tango
216 dance program on activity participation among individuals with PD. Volunteers with PD were
217 randomized to participate in 12 months of Argentine tango classes (Tango group) or to continue
218 their daily routine as usual (Control group). As hypothesized, participants in the Tango group
219 reported increased activity participation over the course of the study. Moreover, they recovered a
220 significant proportion of the activities they had lost since the onset of PD. Activity participation
221 among individuals in the Control group remained relatively stable.

222

223 Our results extend previous work²⁸ and suggest that in addition to improving physical function
224 among individuals with PD, socially engaging and functional, skill-based exercise promotes
225 participation in instrumental, leisure and social activities. The changes in participation observed
226 in the Tango group appear to be driven by a combination of increased engagement in prior
227 activities done less or given up since the onset of PD as well as engagement in novel activities.
228 The only activity domain for which participation did not increase in the Tango group relative to
229 the Control group was High-demand Leisure. Tango participants were required to attend the

230 dance classes and, as such, were engaging in a high-demand leisure activity that was not
231 captured by our outcome measure (because this item was removed); however, they did not report
232 participating in additional exercise activities outside of the dance classes. There are a number of
233 potential reasons for this, including lack of opportunities or access to exercise or being satisfied
234 with the level of exercise offered by the dance classes. Regardless, by engaging in more
235 instrumental, low-demand leisure and social activities, participants in the Tango group did boost
236 their overall level of physical activity, which simply requires bodily movement that increases
237 energy expenditure above the basal level and can include occupational, household,
238 transportation, and leisure activities ³⁹.

239
240 Of the separate activity domains, Low-demand Leisure showed the most consistent
241 improvements, with Tango participants engaging in more of these types of activities by the end
242 of the study than they had before the onset of PD. This outcome is significant, as participation in
243 low-demand leisure activities has been associated with improved mental health in older adults ¹⁴.
244 It is important to note that while the activities in this domain are not as physically demanding as
245 those in the High-demand Leisure domain, many place significant demand on mobility (e.g.,
246 going to the museum, recreational shopping) or other functions affected by PD such as cognition
247 and fine motor coordination (e.g., games, puzzles, needlecrafts). Some also involve social
248 interaction. Thus, rather than representing the adoption of a more sedentary lifestyle, increased
249 low-demand leisure participation may reflect a higher level of daily challenge and engagement
250 for individuals with PD.

251

252 There are a number of ways in which Argentine tango could positively influence activity
253 participation in PD. As a form of physical exercise, it benefits PD-related mobility impairments
254 and may even slow disease progression (for a discussion of these effects, refer to ²⁸), which could
255 result in improved capacity for daily performance and participation. Importantly, progressive
256 tango classes have features that may additively benefit participation compared to traditional
257 exercise. For example, tango requires working memory, control of attention and multitasking to
258 integrate newly learned and previously learned dance elements, stay in rhythm with the music,
259 and maneuver around others on the dance floor. Leading requires self-initiated movements and
260 motor planning while following requires reading and responding appropriately to the leader's
261 body cues ²⁵. These cognitive challenges may further improve capacity for daily performance
262 and result in increases in, or maintenance of, participation.

263
264 The social interaction, social support and social influences that emerged from the tango classes
265 likely also had positive effects on participation. The group setting provided an opportunity for
266 social modeling, the establishment and reinforcement of social norms regarding health-
267 promoting behavior, and the development of social networks ⁴⁰. In fact, participants in the Tango
268 group reported engaging in social activities together outside of class, including attending a play,
269 the symphony, and a social dance. On an individual level, the presence of a partner may have
270 helped those with PD to feel more comfortable challenging themselves in the complexity and
271 difficulty of movements ²⁷, thereby providing the opportunity for mastery experiences, a primary
272 source of self-efficacy ⁴¹. Improvements in self-efficacy that occurred during the tango classes
273 could have translated to daily life, cultivating the desire to go out and engage in more or new

274 activities, re-try activities that had been given up, or devote the necessary effort and persistence
275 required to maintain one's current level of activity.

276

277 **Study Limitations**

278

279 There was no control for attention and social interaction across groups, so it is possible that the
280 changes in participation observed in the Tango group were due to non-specific effects of
281 socializing. However, studies in older adults have shown that exercise outcomes are more
282 strongly predicted by the social cognitive factors associated with exercise, such as improved self-
283 efficacy, rather than by social interaction alone⁴². Thus, we propose that the improvements in
284 participation in the Tango group are larger than what would occur from socialization alone.

285 Future studies should incorporate a social control group and measure social cognitive factors to
286 provide stronger support for this conclusion.

287

288 Our attrition rate was relatively high compared to previous exercise studies in PD^{43,44}. Attrition
289 may have been a function of the research study rather than of the intervention itself. Participation
290 in the study required four off all antiparkinsonian medication evaluations at a separate location
291 from the dance class. This feature likely added a level of burden or discomfort that would not be
292 present in a community-based dance program alone. Importantly, the Tango participants who
293 completed the entire study were actively engaged in the intervention as evidenced by an average
294 of nearly 80% attendance to all classes. This adherence rate is good compared to other 12-month
295 exercise trials in older adults^{e.g., 45}. Furthermore, most of these participants (13/16) chose to
296 continue attending the dance classes after the study was over. Thus, dance appears to be an

297 enjoyable and highly motivating form of physical activity for some people with PD. Formalized
298 follow up, perhaps using the ACS with the “dancing” item re-incorporated, would provide
299 support for this notion and help to determine longer term effects of the intervention. Consistent
300 with the notion that a one-size-fits-all approach to promoting exercise will not be efficacious, but
301 instead, that exercise recommendations should be tailored to individuals’ needs, desires and
302 barriers ⁴⁶, these findings suggests the need for continued identification of alternative, effective
303 forms of exercise for the diverse population of individuals with PD.

304

305 While the ACS provides a broad picture of a person’s perceived participation in complex daily
306 activities, it may not have fully captured all changes in participation in our sample. For example,
307 it allows for the measurement of New Activities but does not include a “Do More” category, and
308 therefore cannot account for increased participation in existing activities. In addition, the ACS
309 does not provide information regarding factors such as length of time spent engaged in activities,
310 the relative importance of activities to people, satisfaction with participation, or difficulty
311 experienced while performing activities. Participation is a complex and multidimensional
312 construct. The present study has provided initial support for the efficacy of community-based
313 dance for improving participation among individuals with PD. Future work can investigate the
314 nature of changes in participation that are occurring as well as the relative importance of the
315 various facets of participation to overall health and well-being in PD.

316

317 **CONCLUSIONS**

318 In summary, we found that engagement in a community-based Argentine tango dance class is
319 associated with increased activity participation among individuals with PD. To our knowledge,

320 this is the first study to test the effect of any intervention on activity participation in this
321 population. Rehabilitation research in PD primarily focuses on motor impairment and physical
322 disability, measuring outcomes at the level of functional mobility and self-care ADL. Given its
323 importance for health and well-being^{14, 16, 47}, optimal participation in all the activities and roles
324 of daily life should be the ultimate goal of rehabilitation for PD and should be a primary outcome
325 in intervention studies. Our findings suggest that dance, a socially-engaging form of exercise,
326 should be included in the clinical management of PD. Future work should examine longer term
327 effects of the intervention and investigate the potential biological and psychosocial mechanisms
328 underlying the benefits of dance for individuals with PD.

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Figures

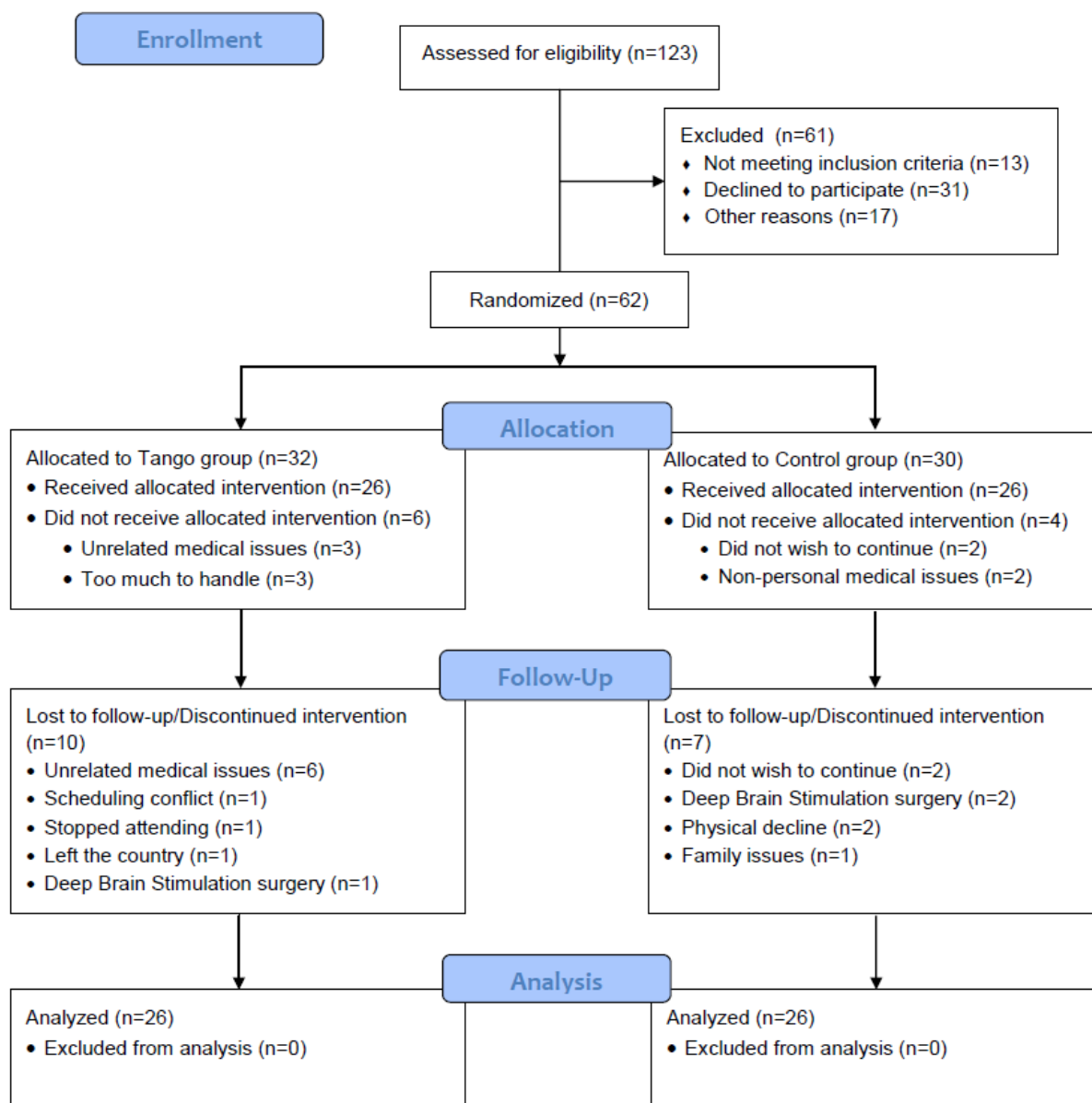


Figure 1. CONSORT flow diagram illustrating participant recruitment, randomization, and attrition. All participants retained through 3 months were included in the final analyzed sample; last observations from those who dropped out after 3 months were carried forward for intent-to-treat analysis.

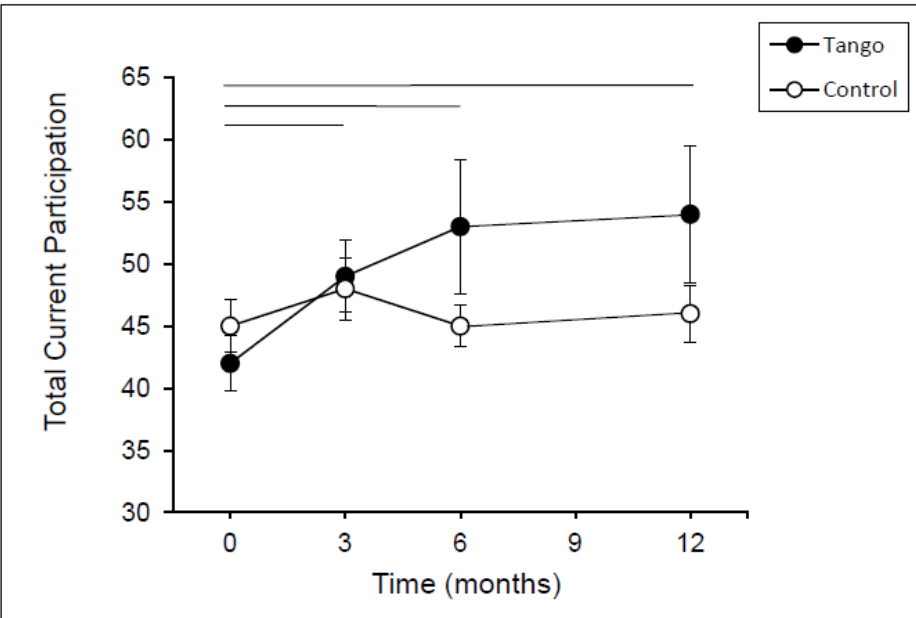


Figure 2. Total Current Participation scores on the Activity Card Sort (ACS) at baseline, 3-, 6-, and 12-month evaluations for the Tango and Control groups. Values are means \pm SEs. Horizontal lines indicate a significant difference within the Tango group between the time points spanned by the line.

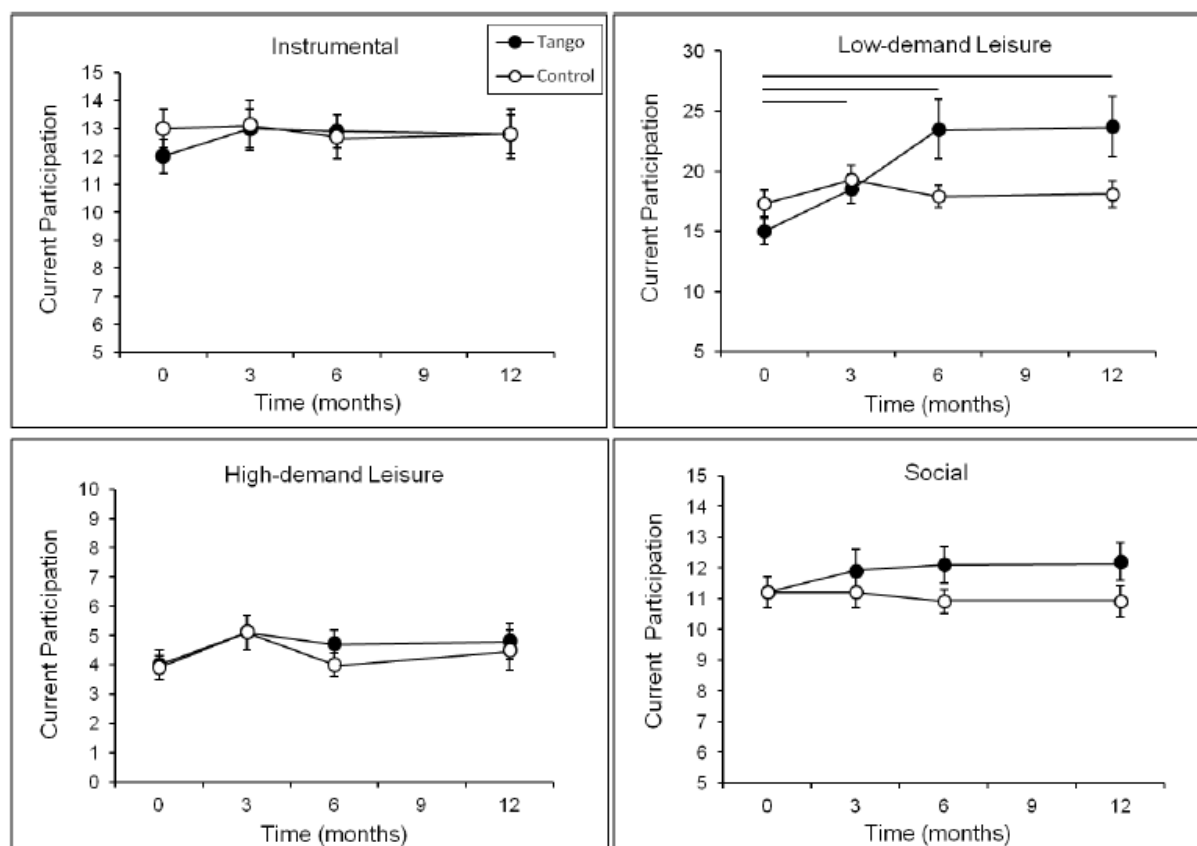


Figure 3. Current Participation scores on the Activity Card Sort (ACS) for each activity domain at baseline, 3-, 6-, and 12-month evaluations for the Tango and Control groups. Values are means \pm SEs. Horizontal lines indicate a significant difference within the Tango group between the time points spanned by the line.

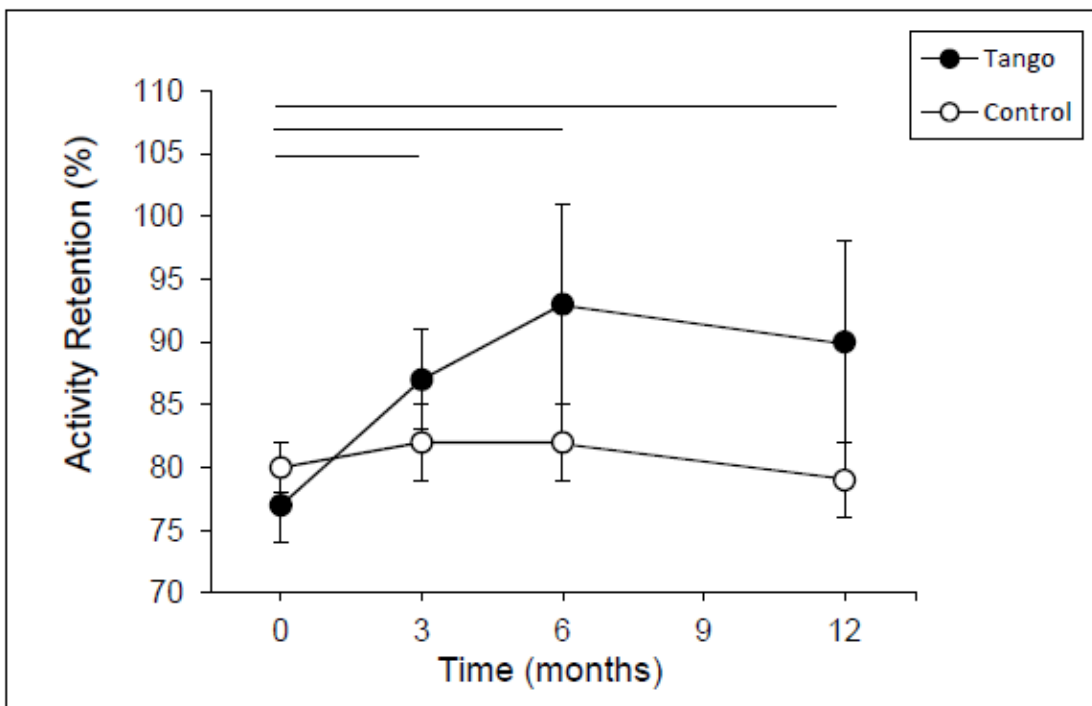


Figure 4. Total Activity Retention scores on the Activity Card Sort (ACS) at baseline, 3-, 6-, and 12-month evaluations for the Tango and Control groups. Activity Retention scores represent the proportion of pre-PD activities currently engaged in, calculated as Current Participation / Previous Participation. Values are means \pm SEs. Horizontal lines indicate a significant difference within the Tango group between the time points spanned by the line.

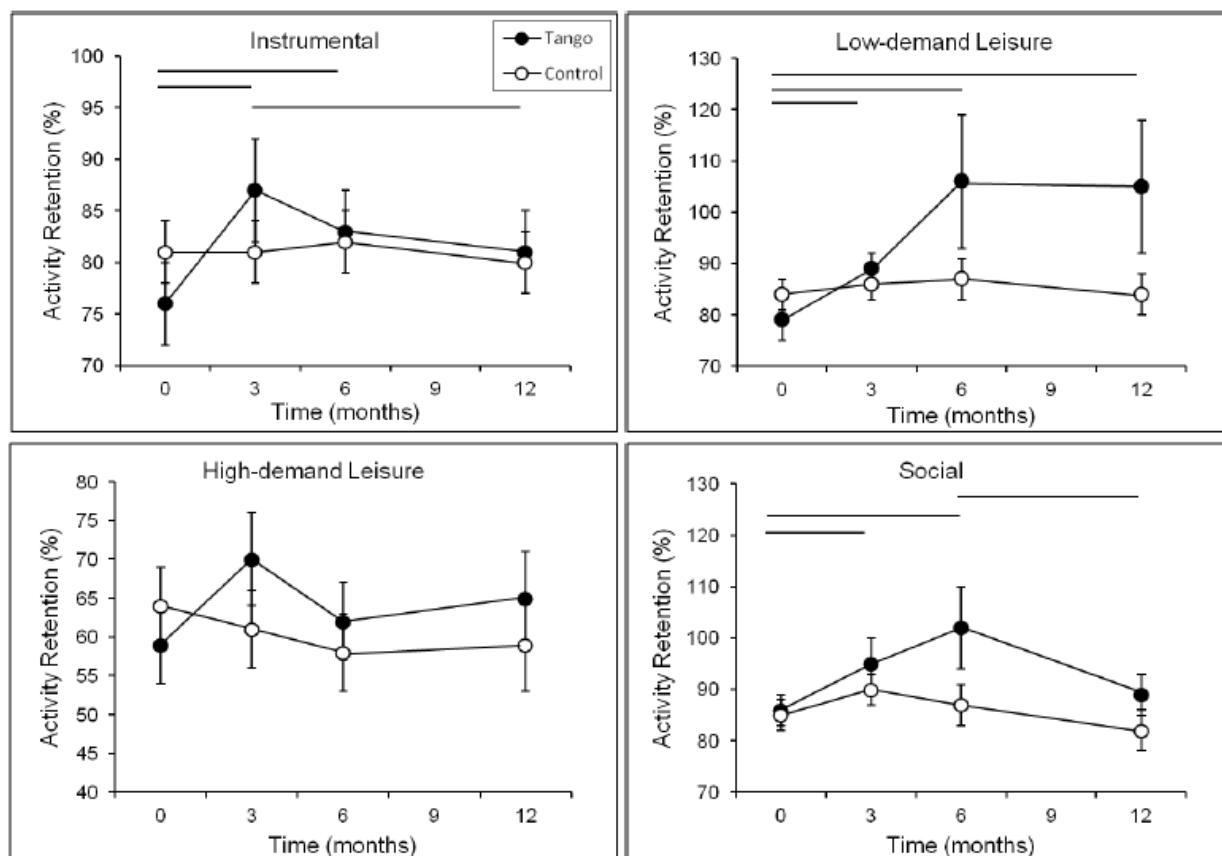


Figure 5. Activity Retention scores on the Activity Card Sort (ACS) for each activity domain at baseline, 3-, 6-, and 12-month evaluations for the Tango and Control groups. Values are means \pm SEs. Horizontal lines indicate a significant difference within the Tango group between the time points spanned by the line.

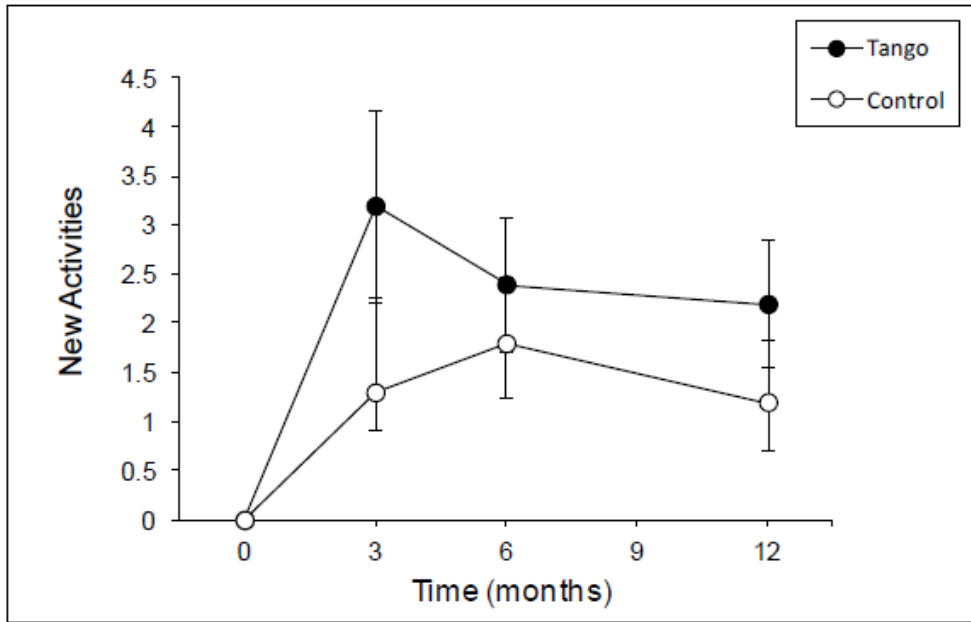


Figure 6. Total New Activity scores on the Activity Card Sort (ACS) at baseline, 3-, 6-, and 12-month evaluations for the Tango and Control groups. Values are means \pm SEs. Horizontal lines indicate a significant difference within the Tango group between the time points spanned by the line.

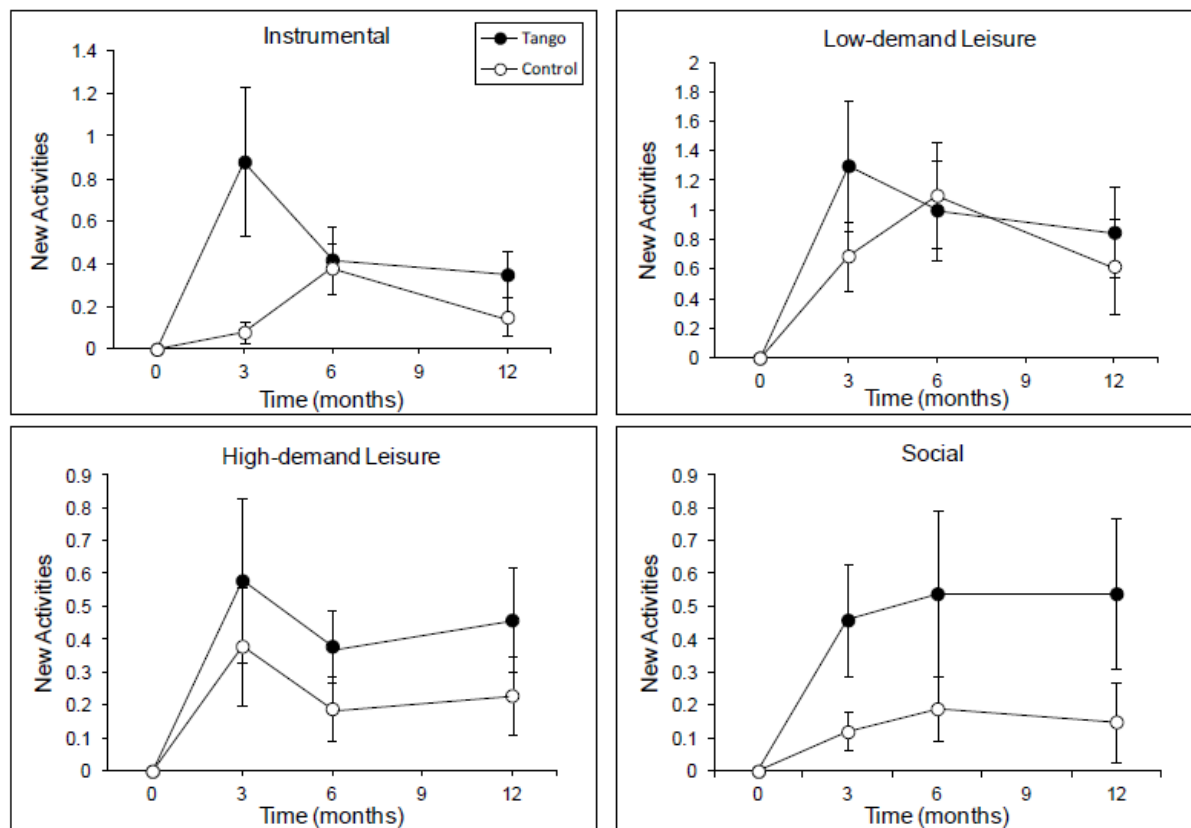


Figure 7. New Activity scores on the Activity Card Sort (ACS) for each activity domain at baseline, 3-, 6-, and 12-month evaluations for the Tango and Control groups. Values are means \pm SEs. Horizontal lines indicate a significant difference within the Tango group between the time points spanned by the line.