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Community-based Argentine tango dance program is associated with increased activity participation among individuals with Parkinson's disease

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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 ≤ 0.008), while the Control group did not change (ps ≥ 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 1-3 [33] (for a complete description of study measures, see [28]). 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 criteria [36], 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 validity [37].

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, $Fs \geq 3.7$,

189     $ps \leq 0.02$, but not the Control group, $Fs < 0.47$, $p \geq 0.70$. 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, $Fs \geq 5.46$, $ps < 0.01$ (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 ≥ 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 work [28] 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 alone [42]. 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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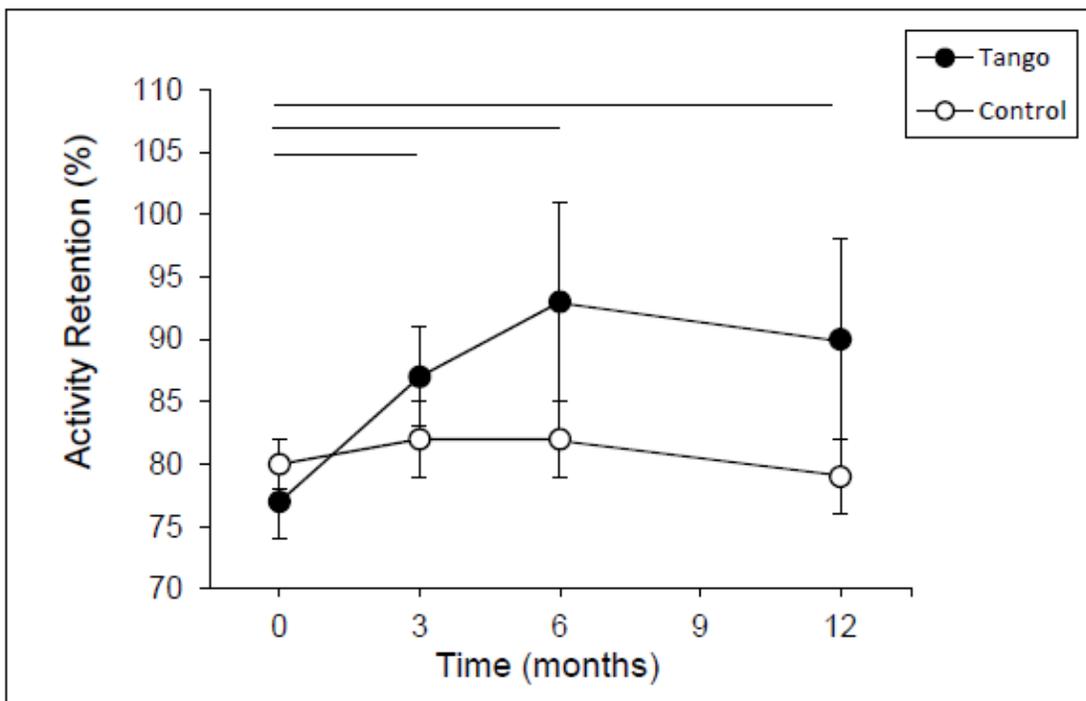
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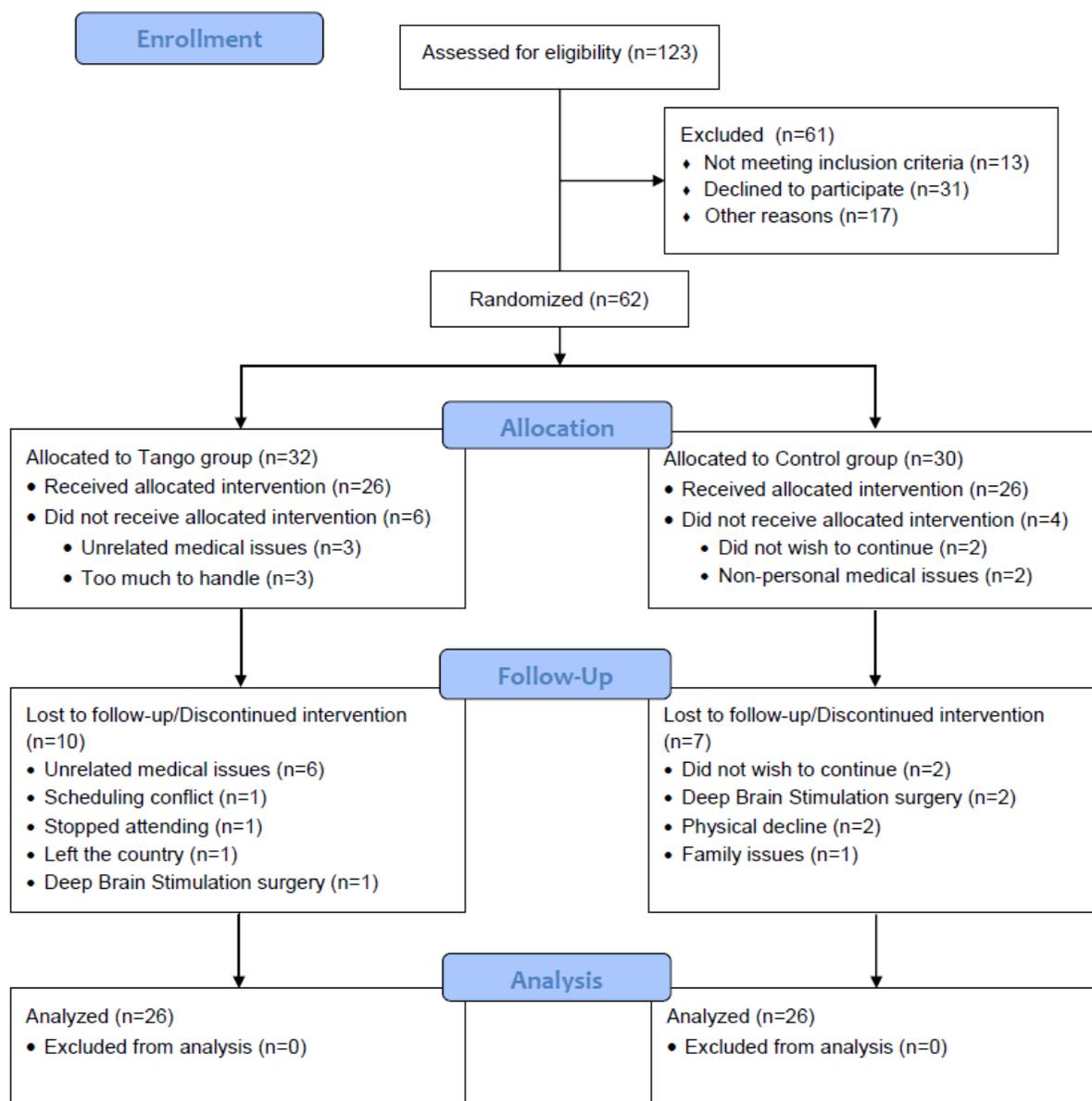
Figure 1. CONSORT flow diagram illustrating participant recruitment, randomization, and attrition. All participants retained through 3 months were included in the final analyzed sample; last observations from those who dropped out after 3 months were carried forward for intent-to-treat analysis.
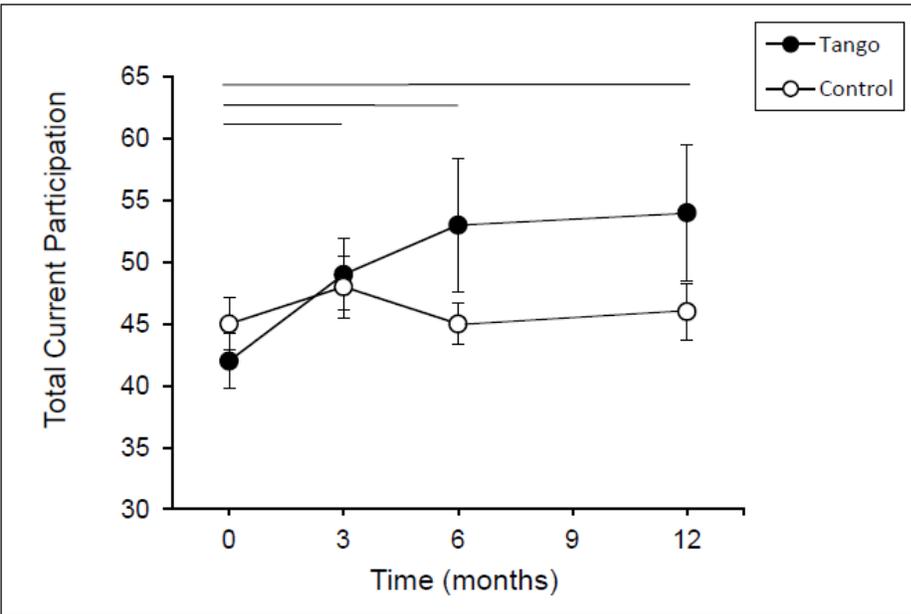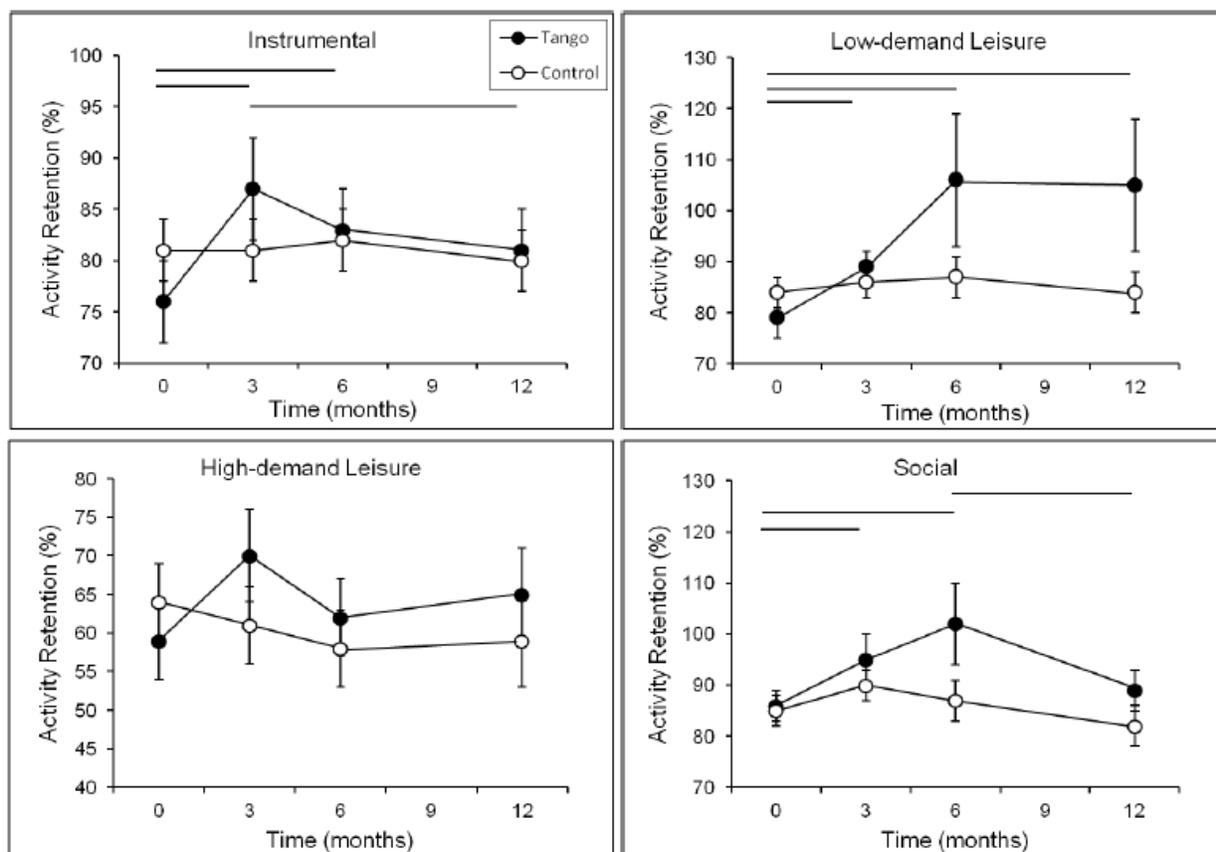
Figure 2. Total Current Participation scores on the Activity Card Sort (ACS) at baseline, 3-, 6-, and 12-month evaluations for the Tango and Control groups. Values are means ± SEs. Horizontal lines indicate a significant difference within the Tango group between the time points spanned by the line.
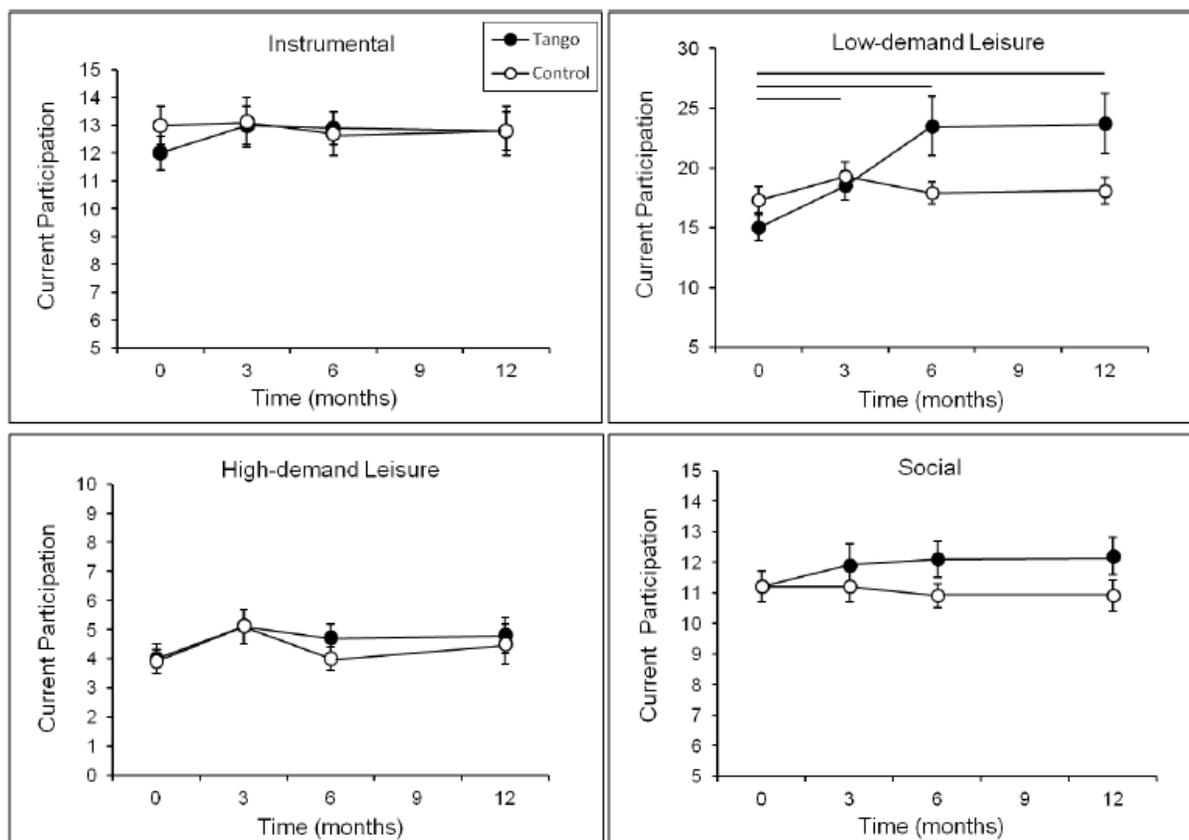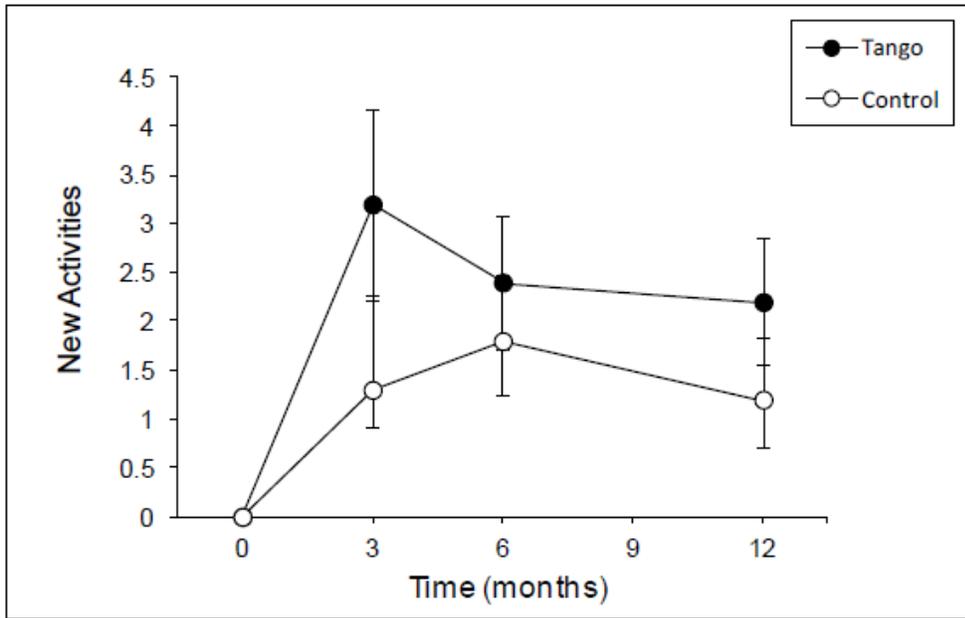
Figure 3. Current Participation scores on the Activity Card Sort (ACS) for each activity domain at baseline, 3-, 6-, and 12-month evaluations for the Tango and Control groups. Values are means ± SEs. Horizontal lines indicate a significant difference within the Tango group between the time points spanned by the line.
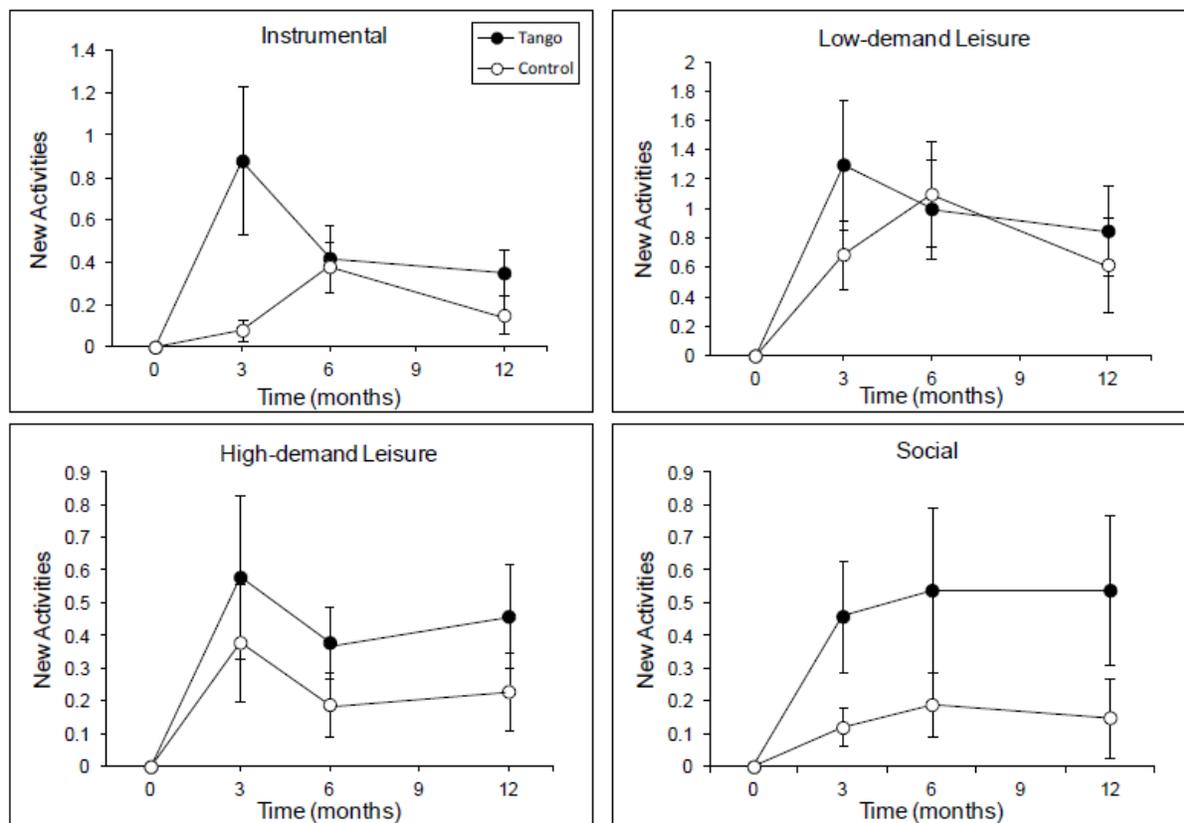
Figure 4. Total Activity Retention scores on the Activity Card Sort (ACS) at baseline, 3-, 6-, and 12-month evaluations for the Tango and Control groups. Activity Retention scores represent the proportion of pre-PD activities currently engaged in, calculated as Current Participation / Previous Participation. Values are means ± 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 ± 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 ± 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 ± SEs. Horizontal lines indicate a significant difference within the Tango group between the time points spanned by the line.